The FOUNDRY

Volume 54
Number 21

Published
Semimonthly

CLEVELAND, OHIO, NOV. 1, 1926

Castings Find Work in Making Automobile Tires

REMARKABLE developments in the processes of manufacturing automobile tires has added greatly to the pleasure of motoring during the past few years. Progress that has been made is illustrated easily by a comparison of the large, easy riding balloon of today with the tires made in the early days of the automobile, when the

Placing Tires in the Cast Iron Molds Preparatory to the Vulcanizing Process

single tube had been tried and found unsatisfactory and the clincher tire was being accepted as the standard. The fine quality of the balloon tire, which came into favor a year or two ago, is due directly to the time and money that has been spent on research by manufacturers to bring about an almost complete mechanicalization of manufacturing processes. The production of an article mechanically requires machines and the tire industry is no exception, since a variety of heavy machines is required to take the crude rubber, the fabric and other materials and shape them into the pneumatic tire. Undoubtedly the foundry industry should have credit for a share in the development, since castings are the basis of the heavy tire molds, presses, vulcanizers, engraving machines, tubing machines, etc. Castings helped produce tires and tubes in 1925 valued at $822,138,213 as compared with a value in 1923 of $563,258,387.

Find Where Castings Can Be Sold

CONTENTS

SPECIAL FEATURES

	Page
Makes History in Engine Building—By Pat Dwyer	846
How Do You Figure Foundry Costs?—By Robert E. Belt	851
Annealing Steel Castings—I—By Larry J. Barton	854
Melting Synthetic Iron in the Cupola—By Frank Hudson	857
Expedite Material Handling—By E. T. Bennington	858
Pattern Checking Facilitated—By W. N. Tuttle	861
Watch Your Grinding Costs—By C. C. Hermann	866
Bill Demonstrates How Soil Pipe Is Made—By Pat Dwyer	868
Control Sand in the Foundry—I—By L. B. Thomas	871
Consider High Resistance Alloys—By L. M. Lamm	874
Grinders Speed Patternmaking—By Walter C. Ewalt	875
Old Iron Articles Dug Up	877

REGULAR DEPARTMENTS

How and Why in Brass Founding — By Charles Vickers	865	Comings and Goings of Foundrymen	882
Milestones in Foundry Progress	879	Foundry Association Directory	883
The Shakeout	880	Foundry Equipment Market	885
Trade Trends in Tabloid	881	What the Foundries Are Doing	886

—⊡—

PUBLISHED BY THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

BOSTON ..... 1037 Old South Bldg.
CHICAGO ..... 1147 People's Gas Bldg.
CINCINNATI ..... 408 Edwards Bldg.
NEW YORK ..... 2203-2206 No. 220 Broadway
PITTSBURGH ..... 2148-49 Oliver Bldg.
SAN FRANCISCO ..... 24 California Street
WASHINGTON, D. C. ..... 1653 Pennsylvania Avenue

FOREIGN OFFICES

BIRMINGHAM, ENGLAND ..... Prince's Chambers
LONDON, ENGLAND ..... 2-3 Caxton House Westminster, S.W.I.
PARIS, FRANCE ..... 23 Rue de la Bienfaisance VIIIe
BERLIN, GERMANY ..... Kurfurstendamm 136, Berlin-Halensee

Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico ..... $3.00 a year
Canada ..... $4.00 a year
Great Britain and other Foreign Countries ..... £1:0:0 a year
Single Copies ..... 25 cents

Copies published three months or more previous to date of current issue, 50 cents each

Member, Audit Bureau of Circulations, Associated Business Papers, Inc., National Publishers Association

Entered at the Post Office at Cleveland as Second Class Matter

Copyright 1926 by The Penton Publishing Co.

Makes History in

Ohio Plant Dating Back Nearly One Position in the Forefront of Industry the Pace in En-

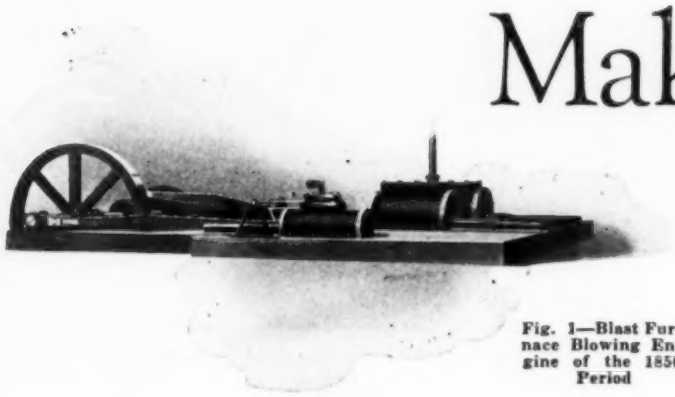


Fig. 1—Blast Furnace Blowing Engine of the 1850 Period

DISCOURAGED and blue, young Charlie Cooper climbed the hill above Zanesville, O., one day in the fall of the year 1833. He climbed the hill because he had nothing else to do and because he had nothing else to do his spirits were at a particularly low ebb. Brought up on a farm near Mt. Vernon, O., Charlie and his brother Elias, upon attaining their majority, decided to make a cast for a living in a wider pool than that provided by the few parental acres. Accordingly they hied themselves to the town of Zanesville, which merely is another way of saying that they tramped part of the way by makeshift roads and the remainder of the distance through the woods and other natural, uncomfortable and contrary features of a new country. They opened a small mine and tried to peddle coal. Among a people accustomed to burn wood and in a territory where wood was cheap and plentiful, their efforts neither were appreciated nor rewarded.

Charlie was ready, nay anxious, to dig coal night and day, but what is the use of digging coal when no customers appear on the scene to take it? This is a question that has engaged the attention of many men since Charlie's time, but it is doubtful if any of them ever felt as completely flattened out as Charlie did on the sunny afternoon in the fall of 1833 when he climbed the hill for perhaps the twentieth time to brood over the situation. He had the instincts of a trader rather than those of a farmer and these in addition to the natural pride of youth which fiercely refused to admit defeat in the first venture, prevented him from returning to the farm. He had started out to make a living by his own efforts and he mentally vowed by the bones of his ancestors who had conquered the wilderness as far west as the Ohio, he was going to do it if he had to die for it. Adversity slowly was beginning to raise Charlie's steam pressure.

While his mind traveled around in the inevitable circle trying to find even a glimmer of a path through which an able and energetic young pioneer could beat a way, his physical eye roamed listlessly over the panorama spread at his feet, where the bustling little town of Zanesville twined itself between the banks and around the junction of two Indian rivers, the Muskingum and the Licking. The coil of black smoke rising from the stack of the old Davis foundry finally arrested his attention and like the pillar of smoke on another historic occasion it pointed the way to deliverance.

This foundry apparently was kept busy all the time and presumably the owner was earning a fair competence. Charlie argued shrewdly enough that people might do without coal, but they certainly could not do without cooking utensils and agricultural implements. These things and many others essential, even in those early days to life, liberty and the pursuit of

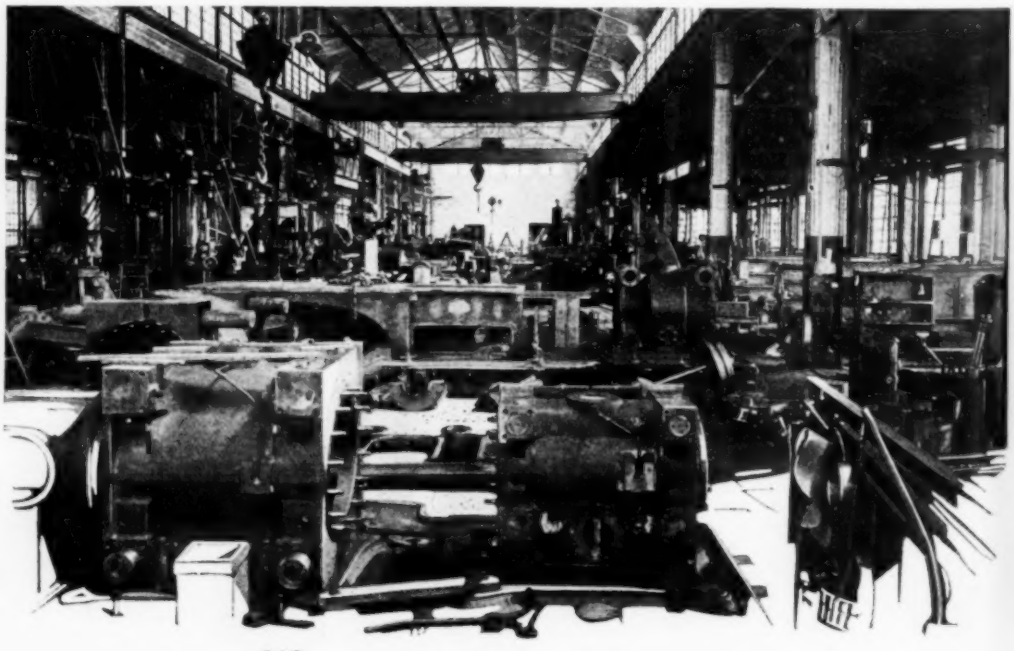


Fig. 2—View of the Machine Shop During the Corliss Engine Period

Engine Building

Hundred Years Has Maintained a by Keeping and Sometimes Setting gine Development

By Pat Dwyer

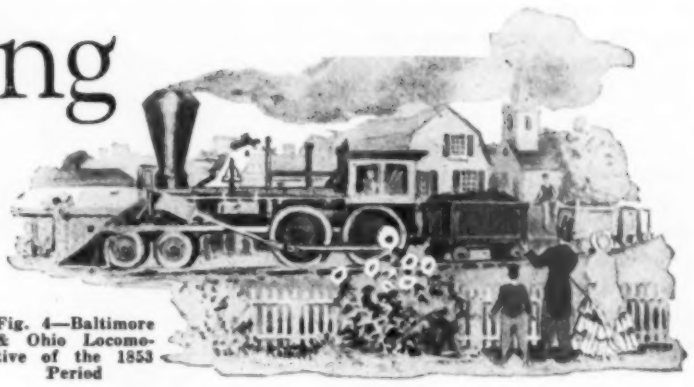


Fig. 4—Baltimore & Ohio Locomotive of the 1853 Period

happiness, were products of the foundry. Charlie decided to become a foundry proprietor.

What perhaps is more to the point, he succeeded perhaps to an extent of which he never dreamed when, in company with his brother Elias, he built a little place in Mt. Vernon, O., and ran off his first heat of 500 pounds of stove parts and plow points. Elias died in 1848, but Charlie, who appears to have been the dominating figure all the way through, constantly expanded the plant and the scope of his activities until he became recognized as one of the leading engine builders in the country.

At various times the name of the firm was changed slightly to correspond with change in the personnel of those associated with Charles in the guidance of its destinies. The business was incorporated in 1895 as the C. & G. Cooper Co., and still is operated under that title. The valiant old man outlived all his immediate relatives and nearly all his partners and only retired from active participation a few years before his death in 1901 at the patriarchial age of 92.

During the period of its existence the plant and organization which he founded have been responsible in large measure for many refinements in the application of steam power in practically every example of prime mover. Beginning with a plain little slide valve steam engine in 1840, the company has kept pace and in some instances set the pace in the development of many types of engines, stationary and marine.

The first blowing engines were built in 1852 and installed at the various charcoal blast furnaces in central Ohio and in the Hanging Rock district. Many of these engines have been adapted to other uses when the furnaces were abandoned. One was in constant use at the Jefferson Iron Co.'s property at Oak Hill, O., for 63 years from 1854 to 1917 when the stack finally was blown out.

A brief description of that first crudely built engine furnishes interesting contrast to the lofty vertical engines built later, before the blast furnace industry turned to the gas engine and the turbo blower. The old engine had one steam and two air cylinders. The 18 x 72-inch steam cylinder was connected by crosshead and iron bound wood connecting rod to the main shaft which drove the two 48 x 72-inch air cylinders through a gear and pinion. The engine was bolted to heavy timbers resting on the ground. At 22 revolutions per minute and 60 pounds steam pressure the engine developed 90 horsepower.

Shortly after George H. Corliss was granted a patent on the rotary valve and automatic releasing gear, the C. & G. Cooper Co. commenced to build Corliss engines in the Middle West. Eventually the line included simple engines in sizes from 25 to 5000 horsepower and compound engines, cross and tandem type from 25 to 12,000 horsepower. A special heavy duty mill engine also was developed and in addition the company extended its activities to the extent of designing and installing power transmission machinery. The company was one of the earliest in the field

Fig. 3—Present Machine Shop Showing Gas and Oil Engines on the Floor

of gas engine design and construction has equipped hundreds of gas and oil-pumping stations with engines in various sizes. Recently it has entered the field of diesel engine construction and gas producer equipment.

From the foregoing presentation, four features stand out prominently: The company has had an unusually long, uninterrupted and successful experience; it always specialized in engines; it has built all sizes and types; it always has maintained a position in the van of progress. As a natural consequence one would be justified in expecting to find something out of the ordinary in the shop practice of this establishment. Speaking simply for the foundry, the only one of the shop group to be considered in the present description the expectation would be fulfilled. Although the range of castings made is extremely wide and the orders for individual pieces are oftener under than over 25, the modern shop methods in vogue compare favorably with those in plants where the individual casting units are comparatively small and where the orders for duplicate parts run into the thousands.

The foundry building 98 x 485 feet is of brick and steel construction with a practically continuous window sash along both sides. Additional light is furnished through a second line of windows on each side of the monitor roof. Part of the west end is occupied with windows. The remainder of the space is taken up by a large doorway through which railroad cars are shunted into and

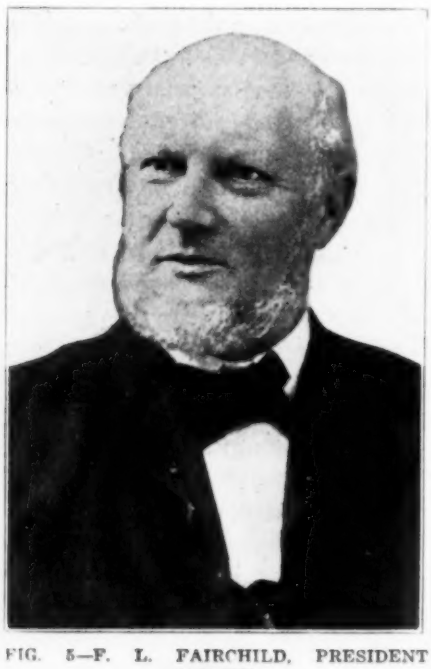


FIG. 5—F. L. FAIRCHILD, PRESIDENT 1868-1912

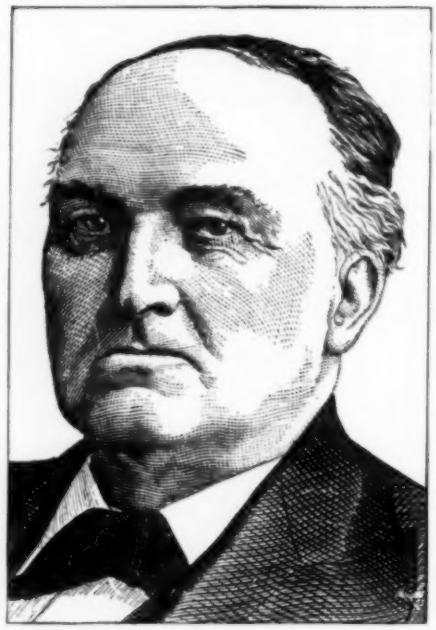


FIG. 6—CHARLES COOPER, FOUNDER, 1833

out of the building. A row of core and mold ovens blocks off part of the light at the east end of the building and the same condition obtains for a short distance at two points on the south wall. The concrete sand bins occupy the space at one point and the cupolas occupy the space at the other. The window sash units are pivoted vertically in the center top and bottom, instead of horizontally according to the usual custom.

General Layout

Introduction of the electric traveling crane to the foundry industry about 40 years ago resulted in the adoption of what since has come to be regarded as a standard type of building and layout for foundry purposes. The main part of the building lies under the runway of the crane or cranes and if auxiliary departments are required they are erected on both sides, usually, but not always the full length of the main part. The layout of the C. & G. Cooper Co.,' foundry at Mt. Vernon, O., conforms to this standard plan, with a central and two side bays all of equal length.

The central bay is served by three main traveling cranes and by ten 1-ton jib cranes. One 50-ton crane was made by the Niles Crane Co., Hamilton, O. The two 30-ton cranes were made by the Shaw Crane Co., Muskegon, Mich., with hoists by the Shepard Crane & Hoist Co., Montour Falls, N. Y. Each of the traveling cranes is equipped with a 5-ton auxiliary hoist. Two 5-ton jib cranes are available at the west end of the main bay where the castings are cleaned. Cores are made and dried at the other end and the space between is devoted to making molds for the larger castings. Also part of the space is utilized as a setup and pouring floor.

Molds for a great variety of medium weight castings are molded in a continuous side bay which parallels the main bay on the north side. This bay is served by two 10-ton cranes made by the Northern Engineering Works, Detroit. One crane in main bay and one in side bay are equipped with magnet control. The molds are dried in a pair of gas heated ovens located at the extreme east end of the bay.

A third bay on the south side of the main bay serves a variety of purposes. The extreme west end is used as a cleaning room for the small castings. It is equipped with a pair of tumbling barrels made by the W. W. Sly Mfg. Co., Cleveland. A large sandblast chamber made by the same company and equipped with a revolving table is located in the adjoining main bay for the reception of castings ranging in weight between 100 and 2000 pounds.

Light floor and bench castings are made in the south bay between the cleaning room and the space occupied by the two cupolas, one lined to 66 and the other to 48 inches. Owing to the practice of only running a heat on alternate days, one cupola can be kept constantly in working condition. The second or smaller cupola has not been used for years, but it is kept in readiness in the

FIG. 7—J. C. DEBES, CHIEF STEAM ENGINEER, 1868

event that it should be required. The usual heat runs from 60 to 70 tons with an occasional high day of 100 tons or over.

The remainder of the space in the south bay is taken up by sand and sand mixing equipment. Two large covered concrete bins erected on the outside of the building are filled twice a year with molding and core sand. The sand arrives in cars on a railroad track which lies close to the bins on the outside and the sand is unloaded by a grab bucket suspended from the boom of a locomotive crane and dropped through hatchways in the covers over the sand bins. With the lids clamped down tightly and a few gas jets kept burning, the sand is prevented from freezing and kept in good working condition during the winter.

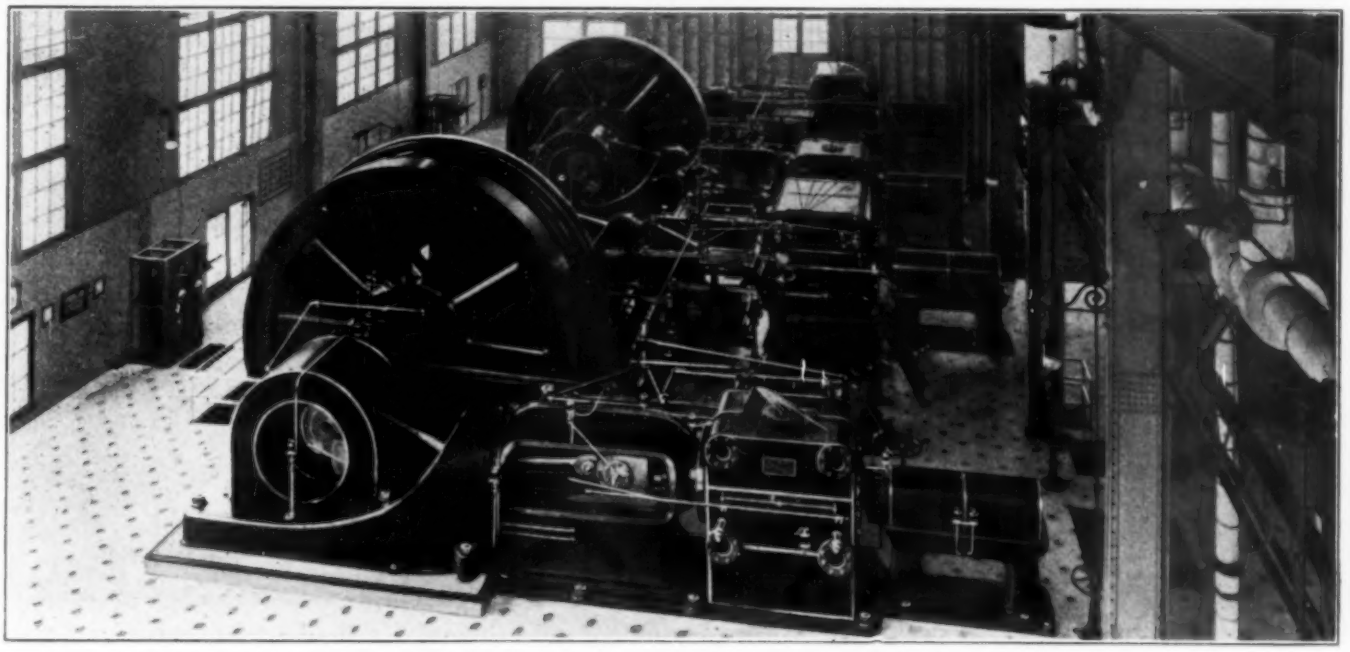


FIG. 8—MODERN GAS ENGINE INSTALLATION IN THE POWER HOUSE OF THE PACKARD MOTOR CAR CO., DETROIT

With the exception of the molds for a few small castings made on the side floor, all the molds are dried. Those that are too large for any of the available flasks are dried in the floor. Several factors influenced the company to adopt the practice of drying all the molds. The first is a legitimate pride in the appearance of the product. A dried mold insures a clean smooth skin and incidentally this reduces the cost of cleaning the casting. The second main reason is that practically all the castings are subjected in service to severe strain either internal or external, therefore the metal must be clean, homogeneous and solid without any trace of interior defect. Dried molds offer reasonable insurance in this respect. A third reason is that dry sand molds may be made more rapidly than similar molds in green sand, due to the fact that so many precautionary green sand features may be omitted.

For many years a famous sand from the east was employed exclusively for facing, but the extremely high freight rates, particularly in recent years has prompted a desire on the part of the company to try a sand nearer home. Experiments along this line were not encouraging until about a year ago when sand from an Ohio deposit was tried with gratifying results. A small percentage mixed with the eastern sand was tried at first. The percentage gradually was increased until at present it is used almost exclusively. The sand carries sufficient natural bond for baking and the facing is mixed in the proportion of half and half new and old sand.

Many of the cores, particularly large cores and cores in which the vent can escape freely, are made from a coarse bank sand bonded with a pitch compound. The remaining cores are made from a sharp sand which contains no natural binder. This sand is bonded with oil in a revolving paddle type mixer made by the Blystone Mfg. Co., Cambridge Springs, Pa. On account of the absence of a clay bond this sand is much more refractory than the other and for that reason it is used to face many of the cores that are composed almost entirely of the other sand. In some cases the entire corebox is lined with a 1-inch thickness of this oil sand. In others this sand only is placed at certain points or areas where maximum refractoriness is essential.

Wide difference that may exist between two apparently similar deposits of sand was illustrated at one of the semiannual sand renewal periods. A slight delay in shipment on the part of the first sand producer caused the company to order a temporary supply from another source at an increased price of $1 per ton. To all appearance it was the same as the first sand, but soon it was found that it required less binder. Where one part of binder to 50 parts of sand was required in the first mixture, one part to 60 parts of sand was sufficient in the second. The saving in binder more than offset the difference in the first cost of the sand and the cores were of a better quality.

Facing sand used each day is just about balanced by the amount of sand which accompanies the castings to the cleaning floor. Old burned sand and core sand from the castings are loaded on a dump car in the cleaning room at periodic intervals and taken by a locomotive crane to a depressed section of the company's property. Eventually when the surface of the reclaimed land is flush with the street level it will represent quite an appreciable increase in value.

Although the shop is in effect a general jobbing establishment, it is operated more in accordance with the methods which prevail in plants where a relatively small number of standard products are made in large

quantities. Almost without exception all the patterns are mounted on boards and the molds are rammed on machines. In some cases a symmetrical half pattern serves for both halves of the mold. In other instances two half patterns are supplied, but the half molds are made independently of each other.

Formerly all large patterns and many small patterns were bedded in the floor. At present only a few of the largest patterns are handled in that manner. It is claimed that the time saved by ramming half a dozen engine bed molds on a machine, as compared with ramming them in the floor, more than offsets the cost of making the flask. Since a good strong cast iron flask will last almost indefinitely, it is apparent that the saving is accentuated on subsequent orders for the same engine bed or for one in which minor changes are incorporated.

As a result of an analysis conducted several years ago, a set of standard sized flasks has been developed to accommodate the exceedingly wide range of patterns. The expedient of drying the molds has greatly simplified the problem of barring the copes, therefor the same flask in turn may be used on a great many patterns differing widely in size and shape. Intimate detail of the ingenious manner in which the sand is prepared for use, also of the manner in which several typical jobs are molded will appear in a later issue of this publication.

Slag the Cupola Through the Front Spout

Question: Our cupola is lined to 24 inches and we melt from 5 to 8 tons a day. Blast is supplied by a positive pressure blower and charges are made up of 600 pounds agricultural scrap, 200 pounds high silicon pig iron, 100 pounds coke and 25 pounds limestone. The iron is hot but the slag hole, located at the back of the cupola and about ½-inch below the tuyeres, freezes during the latter part of the heat so that we have to draw the slag off through the spout with the iron. The wind is shut off temporarily each time the cupola is tapped.

Answer: You have cause for congratulation in getting 8 tons of hot iron per day from a 24-inch cupola under the conditions outlined. Your charges are too heavy, the slag hole is too close to the tuyeres and your practice of shutting off the blast every few minutes certainly affects the even operation of the cupola. Several solutions for your problem are available. The first is to erect a larger cupola. The average 24-inch cupola only has a melting speed of little better than 1 ton per hour, therefore your present heats must extend over the greater part of the day. If your molding conditions are such that a constant supply of metal all day is the most economical method to adopt then the 24-inch cupola is the best. However, if the work can be handled in a manner that will permit all the iron to be poured in one or two hours, then certainly a larger cupola will be found the cheapest and most convenient. In the event that the volume of business dwindles occasionally, the cupola may be lined to a smaller diameter.

Assuming that you will continue to use the 24-inch cupola we suggest you reduce your iron charge to 500 pounds and the coke in proportion. Lower the slag hole to a point 3 or 4 inches below the tuyeres. Use a mild blast 6 to 8 ounces and leave the gate in the blast pipe open all the time. If it is not practical to lower the slag hole at the back you may close it and slag the metal at the front by placing a well and a skimmer block in the spout. However, this only is possible with a continuous stream.

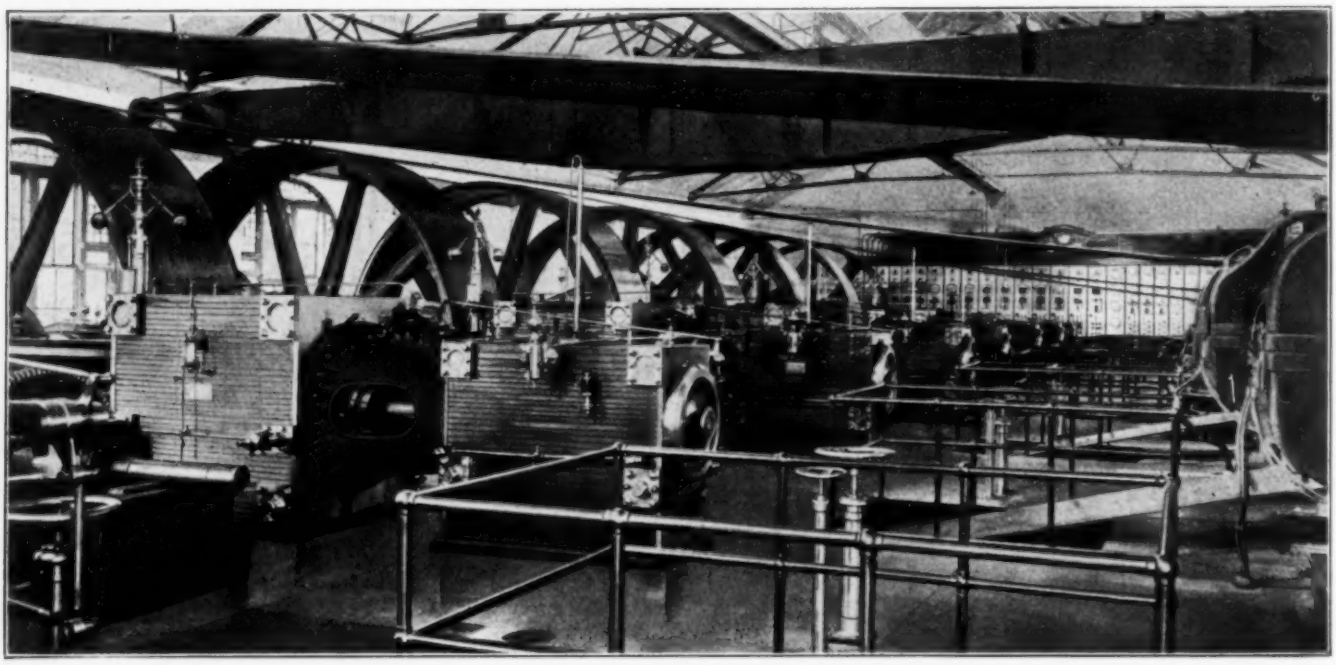


FIG. 9—INTERIOR OF THE POWER HOUSE OF THE ATLANTIC RAILROAD AS IT APPEARED IN 1893, FITTED UP WITH A FULL SET OF CORLISS ENGINES MADE BY THE C. & G. COOPER CO., MT. VERNON, O.

Fall Meeting Is Held

First fall meeting of the Philadelphia Foundrymen's association was held at the Manufacturers club on Wednesday evening Oct. 13. John Howe Hall, research engineer, Taylor-Wharton Iron & Steel Co., High Bridge, N. J., spoke on the recent Detroit convention and some of his researches in heat treating steel.

C. H. Johnson has been appointed engineer in the service department, Timken Roller Bearing Co., Canton, O. He will have charge of installations in the automotive and industrial fields.

How Do You

Figure Foundry Costs?

Competitive Nature of Casting Industry Demands Careful Cost Accounting If the Small Shop Is To Show a Profit

By Robert E. Belt

THE foundry industry, due in part to the character of the product and in part to commercial practices, is a highly competitive one. Therefore, to market castings, without a knowledge of what it costs to produce them is hazardous. It is entirely safe to say, based on the observations and experiences of those coming in contact with foundry office practices, that at least two-thirds of the jobbing foundries of the country do not know where they are making money, if they happen to be making some, or where they are losing money, and to what extent, when their profit and loss account shows in red. Therefore, at least two-thirds of the jobbing foundries of the country do not know, when they quote on work, whether or not they reasonably can expect a profit on it should they receive the order. They do not know definitely on what lines or on what kind of work they have been able to make a profit on in the past. In the absence of an adequate knowledge of costs, they have no experience to guide them and their balance sheet at the end of the year usually reflects the results.

My work in the foundry industry the past several years has brought me in touch with the profits of a great many foundries, and I can say without reservation that the companies at the present time and in the past that know and have known definitely their profitable and their unprofitable work are the companies that are making and have made the best profit showing.

Foundry Accounting not Difficult

To determine the production cost of a casting with reasonable accuracy is not difficult or expensive. However, many foundrymen, conclude, for some reason, that foundry accounting is both intricate and expensive. One reason for this belief, is that in many offices a great deal of effort is wasted; records are not properly related; the cost department, the time department and the bookkeeping department are performing separate operations and making duplicate entries. This is the result of the designing of records at different times to supply certain information which may then be needed, without taking into account other records which are being kept, or of considering the relation of the one record to another in the same office.

An accounting plan should be designed with the same precision as is a piece of machinery, namely, to accomplish, as a whole, a certain thing. Every part of an accounting plan should function just as efficiently as do the parts of any piece of foundry machinery. Unless records are related and the needed information gathered efficiently, there is the appearance, and rightly so, of red tape and questionable benefits. The primary purpose of this article is to demonstrate a method of gathering foundry costs where the records are related and which experience has proven to be both practical and efficient.

It is not claimed that the procedure outlined is exactly suitable to all foundries without some adaptation. However, the claim is made, that with minor adaptations, the principles, the forms, the classification of accounts, the methods of distributing overhead expense, and the procedure in determining the cost of individual patterns of castings may be used in a satisfactory manner by practically every small and medium size gray iron foundry.

Small Iron Foundries

Cost procedure herein set forth is designed primarily for gray iron foundries of the smaller size, as under this head is a larger proportion of foundries in need of more dependable information than in any other class. For the larger gray iron foundries some modification of the cost structure is advisable to provide more detail information and somewhat more accurate costs. However, the fundamental principles, are unchanged regardless of the size of the operations, the principal difference being that of a greater number of cost accounts or subdivisions for the large foundry and of a departmental distribution of fixed plant charges. Furthermore, in some of the larger foundries the costs of certain operations, such as cleaning, chipping and grinding may be recorded separately

Knows Foundry Costs

A COST system, which with minor adaptations may be used in a satisfactory manner by every small and medium size gray iron foundry is given in this interesting article. The article is from a paper presented at the Detroit convention of the American Foundrymen's association, Sept. 27 to Oct. 1.

Robert E. Belt the author of the paper, has been secretary of the American Malleable Castings association since 1917, and successfuly has directed the cost accounting activities in this and other organizations in the foundry industry. A graduate of Ohio Northern university with the degree of bachelor of commercial science in 1905, he entered the National University Law school from which he received the degree of L. L. B. and received the certificate of public accountant of Ohio in 1914. From 1915 to 1916 he was in charge of the division of uniform cost accounting of the federal trade commission, a division organized by chairman Hurley for the promotion of cost accounting activities and uniform cost accounting methods. Mr. Belt, besides being the author of numerous articles which have appeared in the technical press, is the author of a book *Foundry Cost Accounting* which has received wide recognition.

Robt. E. Belt

whereas in the smaller foundries this generally is not practicable.

The first step in a cost structure is an orderly and logical classification of cost accounts, the primary cost divisions following as nearly as possible the sequence of the manufacturing process.

In the classification of cost accounts, Table I, both account number and account names are shown. The system of numbering the accounts is such that the number identifies both the department and the nature of the expense. In each instance, the first number identifies the department and the second number the nature of the expense.

Table I

Classification of Cost Accounts

METAL:
- 10-1 Pig Iron,
- 10-2 Purchased Cast Iron Scrap,
- 10-3 Home Sprue and Scrap,
- 10-4 Steel Scrap,
- 10-5 Alloys.

MELTING DEPARTMENT:
- 22 Indirect Labor,
- 23 Fuel,
- 24 Supplies and Tools,
- 25 Repair Labor and Materials,
- 26 Cupola Relining Expense.

MOLDING DEPARTMENT:
- 31 Direct Labor—Molders' Payroll,
- 32 Indirect Labor,
- 34 Supplies and Tools,
- 35 Repair Labor and Materials.

COREMAKING DEPARTMENT:
- 41 Direct Labor—Coremakers' Payroll,
- 42 Indirect Labor,
- 43 Fuel,
- 44 Supplies and Tools,
- 45 Repair Labor and Materials.

CLEANING, FINISHING AND SHIPPING DEPARTMENT:
- 52 Indirect Labor,
- 54 Supplies and Tools,
- 55 Repair Labor and Materials.

FIXED PLANT CHARGES:
- 60-1 Power, Heat and Light,
- 60-2 Fire Insurance,
- 60-3 Liability Insurance,
- 60-4 Taxes,
- 60-5 Depreciation,
- 60-6 Superintendent, General Foreman, and Miscellaneous Yard Labor,
- 60-7 Miscellaneous Plant Expense.
- Drayage.
- Returned Castings and Allowances.

ADMINISTRATIVE AND SELLING EXPENSE:
- 70-1 Office Salaries,
- 70-2 Office Expense,
- 70-3 General Expense.

The primary cost divisions are:

Metal
Melting
Molding
Coremaking
Cleaning, Finishing and Shipping
Fixed Plant Charges
Administrative and Selling

METAL—The metal accounts constitute the first primary cost division and embrace the cost value of metal of all kinds charged into the cupola.

MELTING—The melting department is that part of the plant in which the iron is melted. The departmental operations for cost determining purposes begin with the assembling of the pig iron, scrap and coke at the places of storage and end with the delivery of the molten metal into the ladle at the spout of the cupola.

MOLDING—The molding department of a foundry is that part of the plant in which the molds are made, including the operations of such shops as serve the molders, such as carpenter shop and molding equipment repair shop. The departmental operations for cost determining purposes comprise in general the operations of assembling the molding materials and supplies, of making the molds, of pouring the molds, of breaking off the gates and heads from the castings, the return of the sprue and scrap to the cupola for remelt, and the delivery of the castings to the cleaning department.

COREMAKING—The coremaking department is that part of the foundry in which the cores are molded, baked, and at times temporarily stored. The departmental operations for cost determining purposes comprise the operations of assembling the materials entering into core sand mixtures, of molding the cores, of baking them and of delivering the finished cores to the molding department.

CLEANING, FINISHING AND SHIPPING—In the larger gray iron foundries there are separate operations and sometimes distinct departments of cleaning, finishing and shipping and accordingly separate departmental operations for cost determining purposes should be observed. In the smaller foundries, these three operations generally are so mixed that cost divisions are not practicable. Accordingly, these operations are here treated as one. The cleaning, finishing, and shipping department may be defined as that part of a gray iron foundry in which the castings are cleaned, chipped, ground and shipped.

FIXED PLANT CHARGES—In a foundry, as in all businesses, there are certain plant charges or expenses of a more or less fixed nature which are not applicable in whole to any one department but which are common to all departments. Expenses under this head consist of power, heat and light, depreciation, taxes, insurance and superintendence. Expenses of this character, where it is practicable, should be distributed over the several operating departments according to the extent each department incurred or shared in such expense. In the larger foundries it is practicable to distribute these so-called fixed plant charges departmentally, but in the smaller foundries it is not generally practicable. Inasmuch, therefore, as this treatise is intended more particularly to fit the requirements of the smaller and medium size foundry, I have shown these general plant expenses undistributed departmentally.

ADMINISTRATIVE AND SELLING—The last general cost division is administrative and selling expense which comprises all expense of the general office covering both administrative and selling functions.

Definition Of Cost Accounts

The second step in a cost structure is a definition of cost accounts. That is, naming or defining what is to be included under each account. In this article the author has included a definition of the several cost accounts for the completion of the subject but has passed over the definitions as they are of minor importance in the presentation of a cost system.

METAL

10-1 Pig iron: To include the cost of all pig iron used, including freight, and labor in unloading.

10-2 Purchased cast iron scrap: To include the cost of all purchased cast iron scrap used, including freight, and labor in unloading.

10-3 Home sprue and scrap: To include the value of all defective castings, sprue, gates, runners, over-iron and spill used.

10-4 Steel scrap: To include the

cost of all steel scrap used, including freight, and labor in unloading.

10-5 Alloys: To include the cost of all alloys used, such as ferromanganese, ferrosilicon, etc., including freight and labor in unloading.

MELTING DEPARTMENT

22 Indirect labor: To include all labor identified with the melting of the iron, such as, handling and conveying iron and fuel to the cupola, charging, daily patching of cupolas, craneman, slag mill labor, blacksmith labor in making and repairing pokers, bars, etc., chemist, foreman.

23 Fuel: To include the cost of all melting fuel used, including freight, and labor in unloading.

24 Supplies and tools: To include the cost of all supplies, such as flux, wood, brick, blocks, and fire clay used for the daily patching of the cupolas.

25 Repair labor and materials: To include the cost of all labor and material used in connection with the upkeep and maintenance of the cupolas and their equipment, exclusive of labor and material for daily patching which are chargeable to accounts 22 and 24.

26 Cupola relining expense: To include the cost of all labor and material used in connection with the periodical relining of the cupolas.

MOLDING DEPARTMENT

31 Direct labor: To include all labor of molders and helpers in putting up molds; operating molding machines, green sand core work; and pouring, when done by molders or helpers.

32 Indirect labor: To include all labor in the foundry other than that of putting up molds, such as, wheeling flasks and sand, wetting sand, cutting and tempering sand, mixing sand and facing, delivering metal to molders' floors, but not including pouring when done by molders or helpers, shitfting mold weights, jackets, or cases, returning patterns to storage, relining foundry ladles, dumping and shaking out molds, breaking gates, gathering up scrap, conveying castings to cleaning department, carpenter labor in the making and repairing of flasks, jackets, bottom boards, etc., foreman and clerks, including pattern clerk.

34 Supplies and tools: To include the cost of all supplies and small tools used in the foundry, such as molding sand, facing, parting, chills, chaplets, flask lumber, molders' tools, riddles, bellows, brooms, brushes, shovels, wood for drying ladles, etc.

35 Repair labor and materials: To include the cost of all labor and materials used in connection with the upkeep and maintenance of the foundry equipment, such as repairs to molding machines and molding benches, molders' tools, etc.

COREMAKING DEPARTMENT

41 Direct labor: To include all labor of coremakers and helpers in making and assembling cores, both piece and day work, including green sand coremaking when made in the core room.

42 Indirect labor: To include all core room labor other than that of actually making cores, such as, oven tenders, pasters, when work is not chargeable directly to the job, loaders, carriers and board collectors, inspectors, counter and tally boys, cleaners, sand mixers and rosin grinders, coke wheelers, pulverizing old cores, core plate collectors, sand wheelers, dispatchers, painters, assorters, wire cutters, and straighteners, delivering cores to foundry, foreman and clerks.

43 Fuel: To include the cost of all core fuel used including freight, and labor in unloading.

44 Supplies and toools: To include the cost of all supplies and small tools used in the core room, such as core sand, core oil, rosin and pitch, compounds, wire, rods, core plates, core-makers' and laborers' tools, etc.

45 Repair labor and materials: To include the cost of all labor and materials used in connection with the upkeep and maintenance of core room equipment, such as repairs to ovens, racks, trays, etc.

CLEANING, FINISHING AND SHIPPING

52 Indirect labor: To include all labor of cleaning, finishing and shipping, such as, loading and unloading mills, operating sandblast barrels, tables, and hose, chipping, grinding, inspecting, sorting, packing, weighing, trucking, loading, cleaning up department, foreman.

54 Supplies and tools: To include the cost of all supplies and small tools used in the cleaning, finishing and shipping department, such as sandblast sand, air hose, stars, jacks, emery wheels, chipping hammers and other small tools, sacks, twine, etc.

55 Repair labor and materials: To include the cost of all labor and materials used in connection with the upkeep and maintenance of all cleaning, chipping and grinding equipment, such as repairs to mills, sandblast apparatus, dust arresters, chippers, grinders, etc.

FIXED PLANT CHARGES

60-1 Power, heat and light: To include the cost of all purchased current; all costs of labor, materials, supplies and expense in producing power; labor and materials in repairing boiler and engine room equipment, including air compressors, accumulators, pumps, generators, transformers, etc., located in engine room; boiler insurance, etc.

60-2 Fire insurance: To include all premiums for fire insurance and all costs of fire protection.

Charge the account monthly and credit Prepaid Fire Insurance account, the entry being one-twelfth of the annual expense.

60-3 Liability insurance: To include monthly premiums on employer's liability insurance policies. Charge the account monthly and credit Prepaid Liability Insurance account, the entry being one-twelfth of the annual expense.

60-4 Taxes: To include all tax payments and assessments on both real and personal property. Charge the account monthly and credit Accrued Taxes account, the entry being one-twelfth of the annual expense.

60-5 Depreciation: To include charges to cover the deterioration in the value of the buildings and equipment due to wear and tear and obsolescence. Charge the account monthly and credit plant and Equipment Depreciation Reserve accounts, the basis being one-twelfth of the annual expense.

60-6 Superintendent, general foreman, and miscellaneous yard labor: To include the salary of the superintendent, general foreman and all miscellaneous yard labor.

60-7 Miscellaneous plant expense: To include all forms of miscellaneous plant expense of a general nature not included elsewhere, such as water rent, employes' welfare, medical and hospital, personal injury payments when not covered by liability insurance, etc.

Drayage: To include the cost of delivering castings to depots and to city customers, and incidental drayage on miscellaneous small items which cannot conveniently be charged to the cost of the commodity.

Returned castings and allowances: To include the invoice price less scrap value of defective castings returned by customers and allowances to customers because of defective castings. Defective castings are those which cannot be reclaimed.

ADMINISTRATIVE AND SELLING

70-1 Office salaries: To include the salaries of clerks, salesmen, and of all general officers.

70-2 Office expense: To include all expense incidental to the office, other than salaries.

70-3 General expense: To include all forms of miscellaneous expense of a general nature that cannot be included elsewhere, such as membership dues, donations, etc., not, however, to include federal income and profits taxes, which are not cost items.

This is the first of two articles on Foundry Costs by Mr. Belt. The second and concluding article will appear in an early issue.

Hear Talk on Sand

At the monthly meeting of the Pittsburgh Foundrymen's association held Oct. 18 in the Fort Pitt hotel. H. L. McKinnon, C. O. Bartlett & Snow Co., Cleveland, spoke on sand equipment in the foundry. Lantern slides were used to illustrate the talk.

Receives Appointment

W. J. Ulrich, formly district sales manager, Detroit, for the Manning Abrasive Co., has been appointed district sales manager for the Carborundum Co., Niagara Falls, N. Y. Mr. Ulrich will have charge of the coated abrasive sales division in the Detroit territory.

H. P. Parrock, consulting engineer in foundry practice, has opened an office at 64 Francis street, Brookline, Mass.

Annealing Steel Castings-I

Specifications for Steel Castings Require Some Kind of Heat Treatment—This Is Necessary That Castings May Be Relieved of Strains and Meet Physical Tests Specified

By Larry J. Barton

SEVERAL years ago the writer was in charge of all metallurgical work for one of the largest steel foundries in the country, which made a specialty of high grade metal, and catered to difficult specifications. This firm used four different melting mediums; acid and basic open hearths, and acid and basic electric furnaces. The facilities for metalmaking were of the best, and practically any specification within reason could be met with metal from one or the other of the various furnaces. When it came to annealing these various heats, it was found that the control and supervision of this item constituted one of the most important and difficult features of metallurgical control. The castings made ranged from small gears of several ounces in weight to locomotive frames weighing 10 or 12 tons; and ranged from the common grades of soft carbon steel to the tricky combinations of chrome, nickel, and vanadium. There were several dozen different specifications to meet, a large number of them depending on annealing manipulation, whether to cool slowly, air-cool, or draw, etc. A large proportion of the work was railroad castings from roads which employed regular staffs of traveling inspectors. Nothing got by and it was a case of turn out the work exactly as called for or lose contracts worth thousands of dollars. Naturally, the metallurgical department controlled the annealing, and the highest type of scientific operation was called for.

To give a concrete example of what was demanded, the following excerpts are taken from the specifications of the Canadian Pacific railway covering vanadium locomotive frames:

Annealing—Each casting must be annealed thoroughly after casting. The manufacturer may give whatever annealing treatment he deems necessary to meet the tensile test requirements of section 4. The following is the treatment recommended by the Canadian Pacific railway:

Each casting is heated to a temperature of from 1650 to 1700 degrees Fahr. allowing it to soak at this temperature for one hour for each inch of width, then withdrawing and cooling in still air. Reheat to a temperature of from 1100 to 1200 degrees Fahr. and hold at that temperature for one hour for each inch of width, then withdraw and cool in still air.

Section 4—Physical Properties—The physical properties are determined from not less than 6 or more than 8 test lugs which are cast integral with each casting in the locations specified on drawings supplied by the purchaser. These lugs must be annealed with the casting, and not more than two lugs are to be removed for the initial test, that the remaining lugs may be annealed further with the casting in case the initial lugs indicate that additional annealing is required. All the lugs must be tested for physical requirements as follows:

	Not less than
Tensile strength	78,000 lbs. per sq. in.
Yield point	45,000 lbs. per sq. in.
Elongation in 2 inches	22 per cent
Reduction in area	43 per cent

Hardness Test—Castings which show serious local hardness during

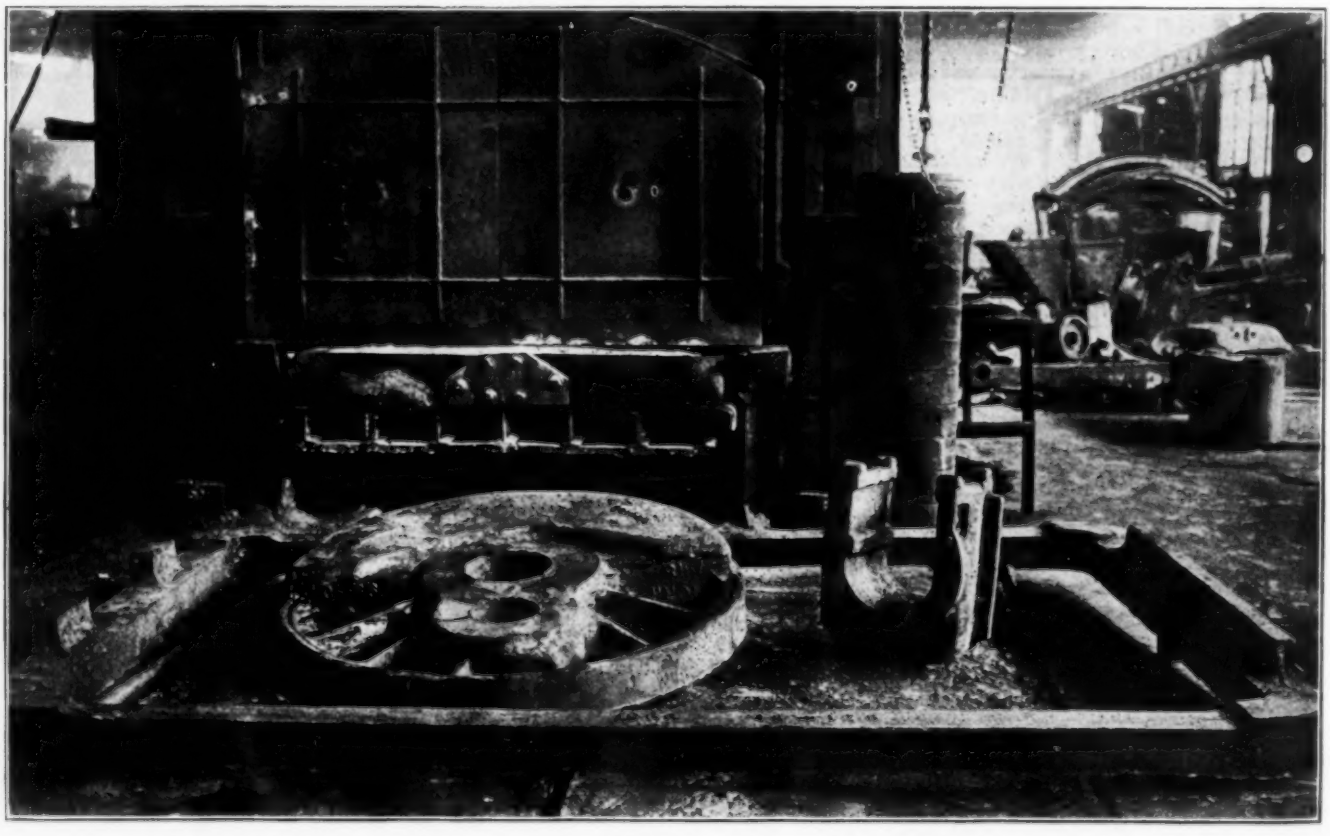


FIG. 1—CAR TYPE ANNEALING OVEN SHOWING ANNEALED CASTINGS IN THE FOREGROUND

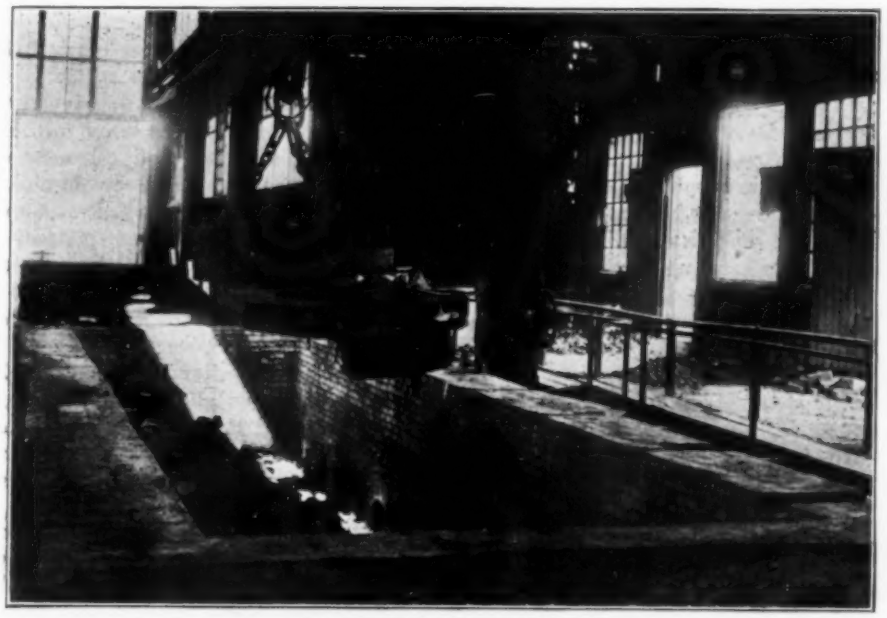


FIG. 2—PIT TYPE ANNEALING FURNACE. THE MAGNET FACILITATES CHARGING AND DISCHARGING THE FURNACE, AND ALSO KEEPS THE MEN OUT OF THE HEAT

machining, making it difficult to machine properly the castings, will be checked when the machining operations have been completed by determining the hardness with a Shore scleroscope. The hardness determinations over the frame in general will be made in not less than 20 places, and if the hardness of the hard spot or spots varies more than 8 points from the average of the remaining determinations the casting will be rejected. Hardness tests as indicated above will be made by a representative of the Canadian Pacific railway.

Test Coupons—The inspector representing the Canadian Pacific railway personally must see to the removal of each test coupon and the immediate stamping of same with its location on the casting, the serial number, and the heat number so that they may be identified after turning of the tensile piece.

Just consider the above. Six to eight test pieces all of which must pass not only tensile test, but also the fractures must be uniform, and show an average anneal throughout the entire piece. When it is considered that some frames are 40 feet long you can see what a delicate job it is to handle this huge casting so that it is heated and soaked in a uniform manner. The difference of a few hundred degrees at any spot on the casting from any other means disaster.

The electric annealing furnace represents the most favorable unit in use at the present time, and while such installations are rather scarce, especially in large sizes, their use is becoming more common due to their manifold advantages of clean, sure heat, and the absolute and close control possible. The majority of the larger foundries continue to anneal by old methods, and have become expert in the handling of their equipment. Annealing is done either in a pit furnace for large work, or in a car type unit for small and medium castings.

A small amount of castings are produced by what is known as the *sand anneal*, that is, after pouring the work is left in the sand until absolutely cold. Several purchasers of rolling mill rolls specify that their work is to be handled in such a manner, but this practice is seldom used. For such work as locomotive frames, wheels, etc., the pit annealer finds wide use. This is nothing but a large, brick lined pit, with a flue on one side, and the firing chamber on the other. Fig. 2 gives a clear view of such an annealer. After the work is loaded the top is covered with a series of brick lined bungs and the fire started. Oil or coal is used as the fuel. A furnace of this character seemingly offers a crude method of annealing, but due to the large loads handled at one time this is not so, and uniform annealing can be performed in this character of unit. However, all such furnaces have their little peculiarities, and for best results these must be known in order that the loads may be arranged that uniformity of heat distribution is maintained.

Fig. 1 gives a general idea of a

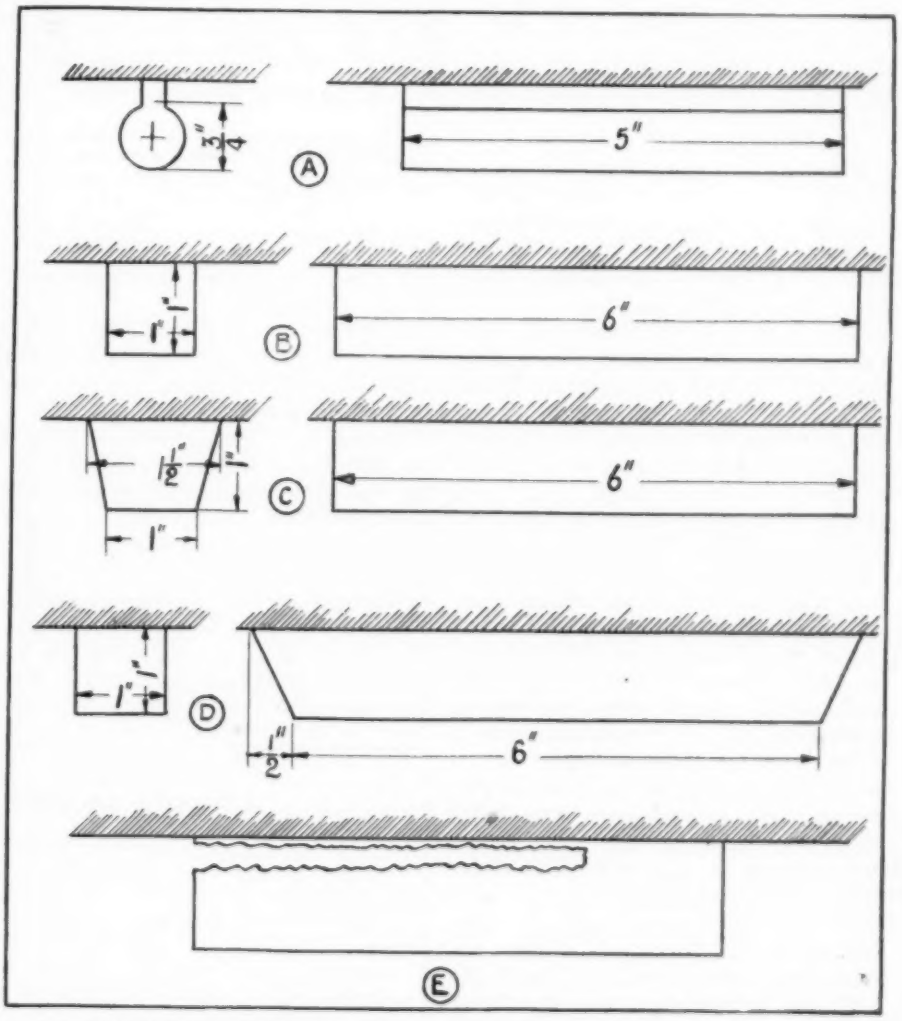


FIG. 3—VARIOUS SHAPED COUPONS ARE ATTACHED TO THE CASTING FOR DETERMINING PHYSICAL AND CHEMICAL CHARACTERISTICS

car type annealer, but as it is common in use in the majority of steel foundries, no comment or description is necessary.

Instruments for checking over temperatures are numerous and of various kinds. Recording pyrometers as a rule are in general use in order that some record may be kept of the annealing operation. Portable pyrometers find wide use in that several sections of the heat may be checked with one instrument. Lately, the optical pyrometer has come into service and is good for checking a large heat, especially one in a pit annealer. This instrument has a filament which is lighted from a battery. The instrument is pointed at the heated castings, the filament lighted, and the power increased or decreased until the color of the filament just blends with the color of the castings being annealed. A scale gives an arbitrary figure which is transposed in terms of degrees. I have found such an instrument to be a great help, but proper precautions must be taken to see that a true reading is obtained. Smoke and haze seriously interfere with the correctness of the reading, an accuracy cannot be obtained until the steel has reached approximately 1400 degrees as the color comparisons are too hard for the eye to distinguish. The most important thing in scientific annealing is to be sure that the instruments used for temperature control are considered only as an aid and not absolute. I often have seen a heat with at least 300 degrees difference in certain sections, and when the operator was informed of this he pointed to the recording pyrometer which showed exactly the temperature desired. However, such occurrences are passing rapidly, and cannot be tolerated under the rigidity of existing specifications.

One prolific source of trouble found under such intensive testing is the failure of test bars due to flaws, occurring usually from a small sand spot or blow hole occuring in the body of the test coupon proper. On certain classes of work the inspector will bend the test coupon cold, and accept or reject the work upon the result of this cold bend. Generally, this will not be satisfactory and other coupons must be machined and pulled, certain cases even occurring where castings must be cut up to supply coupons. Consequently, the greatest care is exercised in the placing of the test pieces on the casting, and in the shape of the test piece itself. These test pieces, if possible, are placed in the drag under a heavy section of the casting which will feed it adequately during solidification, and are placed that the metal during pouring will flow through this area, thoroughly washing out any loose sand particles, etc. On certain castings, such as locomotive frames where the position of the test piece is specified, the greatest care is taken to assure that the test piece will wash free of sand, and will feed thoroughly. This is cared for by shaping the test coupon to give the results required.

Fig. 3 shows various test bars, their shape, and the manner in which they are attached to the casting. *A* shows the common type of bar used on bolsters, side frames, and other such classes of castings. Six or eight of these are made in every heat, and all the castings of this type poured in that heat are accepted on the results of these few test bars. By making the small neck shown the inspector can knock the coupon loose from the bar with a hammer after annealing. This is quick and also allows him to judge the fracture at the break, and to compare the fracture of the other bars of the same series. Then, if the first bar pulls up, it is reasonable to assume that all the castings from this heat are acceptable. This type of bar usually is cast in a special core.

B is the ordinary type of bar attached to main frames, cross heads, cylinder heads, driving boxes, etc., and is made directly in the body of the mold. *C* is used on similar work where the position of the bar is specified, and where the wash of the metal is from the side. *D* is the same, but the wash of the metal is from the end. These types eliminate sharp corners and pockets, where a small bit

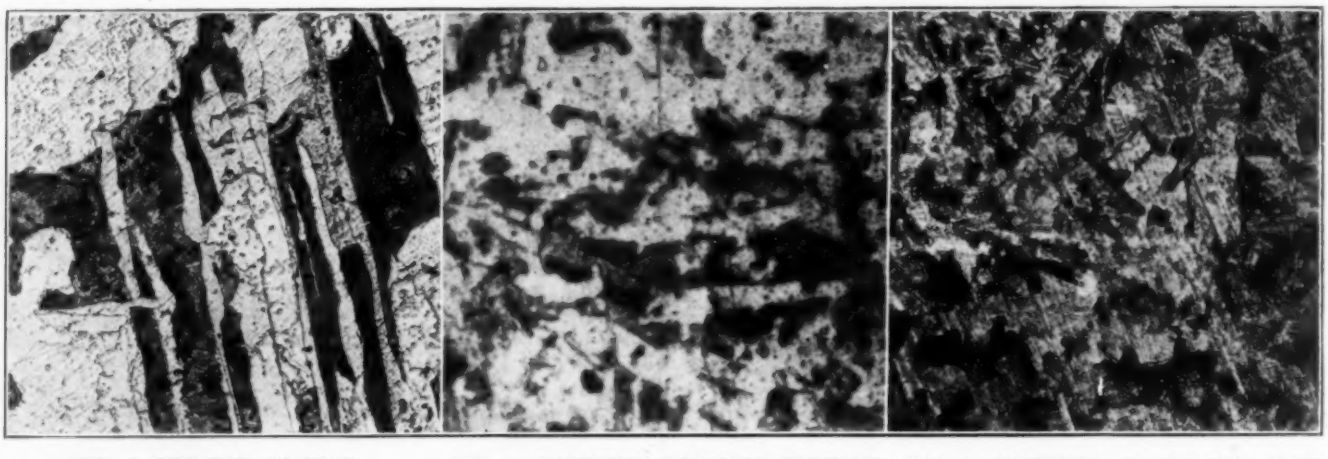


FIG. 4—THE BAR AS CAST

Tens. St. .....67,250 lbs. per sq. in.
El. Lim. .....34,250 lbs. per sq. in.
Elong. ..... 30 per cent
Red. Area ..... 43.4 per cent

FIG. 5—ANNEALED IN SMALL ELECTRIC FURNACE, SLOW COOL. HELD AT 1470 DEG. FAHR. FOR ONE HOUR. FRACTURE PRACTICALLY RAW

Tens. St. .....67,500 lbs. sq. in.
El. Lim. .....36,000 lbs. sq. in.
Elong. ..... 30 per cent
Red. Area ..... 49.4 per cent

FIG. 6—ANNEALED AT 1650 DEG. FAHR. HELD AT TEMPERATURE 1½ HOURS, COOLED IN FURNACE. FRACTURE GOOD

Tens. St. .....70,000 lbs. sq. in.
El. Lim. .....38,500 lbs. sq. in.
Elong. ..... 29 per cent
Red. Area ..... 53 per cent

Comparisons of Test Coupons

BARS BURNED FROM BLOCK

	Pounds per square inch					Average
Tensile strength	76,000	76,500	76,600	76,500	75,900	76,300
Elastic limit	38,500	38,250	40,000	38,500	37,920	38,634
Elongation, per cent	27	27	27	28	27	27.2
Reduction in area, per cent	39.2	43.4	41.9	41.9	43.4	41.9

BARS MACHINED FROM BLOCK

	Pounds per square inch					Average
Tentile strength	76,400	75,750	76,500	76,300	76,420	76,274
Elastic limit	39,500	38,750	38,350	38,400	38,200	38,652
Elongation, per cent	27.5	27	27	27	28	27.3
Reduction in area, per cent	39.7	40	43	41.9	41.9	41.3

of sand or dirt could collect and be held, later appearing as a flawed bar. *E* shows the manner in which these bars are cut with the torch before annealing. After the anneal the inspector can use his hammer to break them off, and has a clean fracture for his examination.

Considerable comment has at times appeared upon the results of cutting coupons in this manner with the acetylene torch. Some claiming that this treatment so injures the metal that it is not in perfect shape, even after the following anneal. To prove or disprove this, a test was made as follows: Ten test bars were cast on the under side of a large block from an open hearth heat analyzing carbon, 0.29 per cent; manganese, 0.60 per cent; phosphorus, 0.037 per cent; silicon, 0.32 per cent, and sulphur 0.047 per cent. Five of these bars were cut from the piece with the torch, and the other five were machined free. All were then annealed at the same time to 1700 degrees Fahr. soaked and slow cooled. Results obtained are shown in the accompanying table.

Results indicate that there is no difference in the manner used to separate the test coupon.

Melting Synthetic Iron in the Cupola

By Frank Hudson

CONFIRMING in its entirety the paper presented at the recent convention by T. F. Jennings and published in the Oct. 1 issue of THE FOUNDRY on melting entire heats of steel scrap in the cupola, I might say that the best cupola melted metal I ever have seen was produced from an all steel charge. The practice was carried on for a considerable period in a European foundry where this synthetic iron was made for the purpose of remelting for high duty castings, locomotive cylinders, diesel engine castings. Frequently locomotive piston valve liners were cast direct. The general practice of bringing the iron up to the required analysis was to make up the charge with 75 per cent steel scrap and 25 per cent 6 per cent silicon low phosphorus pig iron. At times this pig was not available and on these occasions the charge was made up of all steel scrap with suitable ferrosilicon and ferromanganese additions. About 20 tons of this metal was melted daily and the following items of melting practice present points of interest.

Silica brick was found most durable in the melting zone. A cupola made by the Whiting Corp., Harvey, Ill., lined to 45 inches inside diameter and with a rated capacity of 8 tons per hour was employed to melt the metal. Ratio of the tuyeres to the cross sectional area of the melting zone was as 1 is to 3.8. Bed charge of coke weighed 2240 pounds and each of the steel charges weighed the same amount. From 280 to 308 pounds of coke were placed between the charges of metal depending on the character of the scrap. Excluding the bed the melting ratio of coke to metal was 1 to 7.4. Fluxing material to the extent of 56 pounds of limestone and 28 pounds manganese ore was used on each charge. The blast pressure averaged 26 ounces and the volume about 3600 cubic feet per minute according to the condition of the material in the charge.

With an addition of 16 pounds 80-per cent ferromanganese and 60 pounds 50 per cent ferrosilicon the average analysis of the resulting iron was: total carbon 3.00 per cent, silicon 1.02 per cent, manganese 1.23 per cent, phosphorus 0.08 per cent sulphur 0.08 per cent.

Ferromanganese and large pieces of ferrosilicon were placed with each charge in the cupola and about 10 pounds out of the 60 pounds of ferrosilicon was added as dust in the cupola spout to take care of oxidation. No trouble ever was experienced with dull iron. In fact and as a rule the metal was much hotter when melting steel scrap than when the cupola was running on gray iron mixtures. Average temperature of metal at the spout was 1400 degrees Cent.

A great deal of ferrosilicon was lost through oxidation and finally a better method was adopted. A larger quantity of 5 to 6 per cent silicon low phosphorus pig iron was added to the charge.

The resulting iron machined readily and showed a tensile strength of 40,320 to 47,000 pounds per square inch and a transverse strength of 15,680 pounds dead load with 0.11-inch deflection on a 1 x 2 x 14-inch bar broken over 0.12-inch centers through the 1-inch side.

All the molds into which this metal was poured were made of dry sand and were poured while heated. In several instances railroad inspectors have hesitated to accept these high test castings on the plea that the material really was not cast iron.

The name of the Pneulec Machine Co., Ltd., Smethwick, Birmingham, England, manufacturer of foundry equipment, has been changed to Pneulec Limited. There has been no alteration in the personnel of the company or in its policies or operation. This company manufactures molding machines, core machines, core oils, cupolas, melting room appliances, and miscellaneous foundry supplies and equipment.

Sand Sticks To Pattern

Question: We will appreciate any information that will enable us to prevent sand from sticking to our aluminum matchplates.

Answer: Under ideal conditions where the plate is smooth, warm and dry and where the sand is just damp enough to hold together, no sticking will take place. Since all these conditions are impossible to maintain under actual working conditions various auxiliary agents have been employed as parting mediums. The usual method is to shake a slight film of lycopodium or other proprietary powder sold for the purpose, over the face of the pattern and plate before placing any sand in the flask. Kerosene, gasoline and naptha which evaporate rapidly are sprayed over the surface or rubbed on with a rag each time the plate is taken out of the sand.

To speed production the average molder prefers to work his sand a little damper than actually is necessary. Also to insure a good *lift* each time he is prone to add an excess amount of new sand while cutting over his sand heap. These two features increase the *stickiness* of the sand and causes some of it to adhere to the plate. Sometimes warm sand is rammed against a cold plate and the condensation of moisture causes the sand to stick. Certain sands with a high clay content stick worse than others. With the various foregoing features in mind you probably will be able to develop preventive measures for your particular case. Some foundrymen apply one or two light coats of shellac to their aluminum plates.

Expedite Material Handling

Possible Improvements Depend on Arrangement and Size of Machines for Transporting Materials in Plants

By E. T. Bennington

IN SPITE of the fact that various industries use different methods, two fundamental principles are employed in every successful material handling installation regardless of the industry in which it is used. Principle No. 1 is to increase the size of the unit of production and principle No. 2 is to pick up the load where it is and take it to its destination without rehandling.

Engineers fast are beginning to realize the tremendous importance of principle No. 1. Not over five years ago the largest bundle of wire produced by any wire mill weighed 150 pounds. When the Minnesota Steel Co., Duluth, built the new wire mill wire drawing equipment and material handling machinery were installed to handle bundles of wire weighing 300 pounds. More than one wire mill engineer told us that the new mill would be a failure, but today there is not a large wire mill in the country that rolls a bundle smaller than 300 pounds and many of the small mills have revamped their machinery to increase the size of the bundle. In many cases they had to do it or go out of business. A new wire mill under process of construction will roll and draw a 750-pound bundle. The reason savings are effected by increasing the size of the unit of production in a wire mill is due to the fact that a block drawing a 300-pound bundle of wire need be stripped only half as often as if drawing a 150-pound bundle. One man can take care of twice as many blocks and can keep all the blocks more continuously producing wire and not shut down so often to be reset with new bundles. The same principle holds true in a galvanizing department, as well as in making nails, rivets, barbwire, etc. With the larger bundles these machines don't have to be set up and started so often. The saving in labor is tremendous. Of course the use of large bundles makes it necessary to use material handling machinery and as long as material handling machinery must be used there is no reason why the unit of production in a wire mill should stop at 300 pounds. A 750 or 1000-pound bundle is thoroughly practical and it won't be many years before it is the common unit of production.

Size of Units Increased

The common warp beam used in the textile mill a few years ago weighed 50 pounds and men carried the beam about the factory on their shoulders. We have seen the weight of the beam rise to 150 pounds, then 300 and there are a few mills about the country that employ a 600-pound beam. In some of these textile mills the 600-pound beam will keep a machine running two weeks continuously before the machine is shut down to receive a new beam. Usually several hours are required to start a new beam in the machine, but it does not take any more time to start a 600-pound beam than it does a 50-pound beam but the nonproductive time on the machine is only one-twelfth of what it would be if a 50-pound beam was used.

Our company recently installed material handling machinery in the largest artificial silk plant in the world to handle artificial silk on a 1-ton spool. Rubber mills in the past few years increased the size of rolls of friction fabric from 300 and 400 pounds to a ton and over, with a tremendous saving in nonproductive time on the calendars, bias cutters, etc. Paper mills all over the country are increasing the size of the rolls of paper. Bakeries are baking bread in 1-ton lots where formerly it was handled and baked in a manner which practically amounted to baking the dough in individual loaves.

Some bolt and nut factories are handling their products in 1-ton units, where they formerly handled them in 50-pound tote boxes. Candy factories are cooking, pouring and mixing candies in ladles that hold from 500 pounds to a ton. Ice plants are pulling entire rows of cans from the freezing mixer where not many years ago they were drawing single cans and in some cases did not employ machinery for this purpose.

Foundries are increasing the size of the ladles and flasks. Some foundries are pouring molds from ladles holding 1500 pounds. One foundry installed flasks 8 or 10 feet long and a molding machine to set up molds in these flasks with material handling machinery to handle the flasks and handle the ladle while pouring, and also to carry the castings to the cleaning room. The product was cast iron pipe but if the product had been valve castings or pipe fittings or any one of a thousand different castings that are made today, we know many foundrymen would say that it would be impossible to cast 50 or 100 small castings in a flask of the proper size and probably would

Suggests Improvements

THE subject of handling materials in the foundry has been given considerable study by the author of the paper on "Materials Handling in the Foundry," which was presented at the Detroit convention of the American Foundrymen's association, Sept. 27 to Oct. 1.

E. T. Bennington, the author, for several years has been connected with plants manufacturing materials handling equipment and he has made a special study of the subject. He took two special courses with the International Correspondence schools in the design and construction of electrical machinery. Mr. Bennington was connected with Erner Electric Co. for five years as a salesman in charge of the power apparatus. Leaving this company he was in the electrical contracting business in Cleveland, and for two years was president of the Cuyahoga Power Constructing Co. Later he became associated with the Cleveland Crane & Engineering Co. as manager in the electric tramrail division.

E. T. Bennington

prove that they were correct in their contention.

Many wire mill engineers will tell you that no wire mill will produce a 750 or 1000-pound bundle of wire successfully. If you want to go into details with them about the matter they will prove that it cannot be done, but in a short time you are going to see it done successfully and you will find the engineers who say today that it cannot be done, doing it in their own plant. Larger units of production in foundries surely are coming. Larger ladles and larger flasks with more castings to a flask or to a pattern and with these larger units of production we will see material handling machinery used more extensively. In the majority of foundries today the size of the flask is limited to the weight that one or two men can lift, but when the lifting is done more generally with machinery the size of the units of production will increase rapidly.

It is not only the size of the ladles and flasks that can be increased and the size of the bucket or unit that conveys the rough castings into the cleaning room, but the size of the tumbling barrel and rattler also will increase the material handling efficiency. A tumbling barrel that will clean one or two tons of castings will clean its charge just as quickly as a smaller machine that cleans only 400 or 500 pounds. If the nature of the castings to be cleaned will permit the use of larger units, and practically all castings are so adapted, the cost of cleaning will be reduced materially.

Application of Principle No. 2

Principle No. 2 is to pick up a load and carry it to its destination without rehandling. This principle is just as important as principle No. 1, and is capable of much wider application to foundries. A great many material handling machinery applications in foundries are laid out without due regard to completing the handling of a load in one operation.

Recently we visited a foundry that had just completed an installation of an elaborate system of material handling. Roller conveyors, slat conveyors, monorail systems, cranes and belt conveyors were used extensively. A monorail system was employed to remove a mold from a large molding machine and place it on a slat conveyor on which it was moved to a point where the pouring was accomplished from another monorail system. As this mold continued to travel along the conveyor, the casting was given sufficient time to set, the flask was picked up by another monorail system, shaken out and then conveyed to an inclined roller conveyor where the empty flask was returned in the general direction of the molding machine. At the end of this roller conveyor it was picked up again by a monorail system and conveyed to the molding machine.

Single Handling

In many other industries we have seen a load just as fragile in nature as an unpoured mold handled through many operations by one type of material handling machinery. We believe that manufacturers could install slat conveyors in such a way that they would handle this flask through the entire operation of pouring, shaking out and returning the empty flask without necessitating the rehandling of the flask. We know positively that monorail builders would have picked the flask off the molding machine in such a way as to permit the cores to be set before closing the mold and carry the flask through all the operations of pouring and shaking out and returning the empty flask to the molding machine without rehandling and at a considerable saving in labor.

According to a paper presented at the Syracuse convention by T. C. Flinn, brass foundries probably would average 152 tons of material handled to produce one ton of castings and that iron foundries probably would average 206 tons of material handled to produce one ton of castings. This means that the same material is handled over and over again. We know that a great many rehandled operations can be eliminated in foundries and without increasing materially the cost of the material handling machinery. We know of no other industry that handles so much material, or rather rehandles so much material in proportion to the weight of the product.

Application of material handling machinery in the core room would have to be approached in an entirely different manner. Many other industries successfully have applied material handling machinery to problems that are exactly the same from a material handling standpoint.

It is not a difficult problem to handle cores from the core bench into the oven and out of the oven to storage or to the molding floors in one-ton lots and without rehandling the cores separately. Usually we recommend that when in storage they be not rehandled but left on the rack in which they were placed originally. A rack on wheels or on a skid does not cost much more than a good rack on the floor and if it is on wheels or on a skid it is capable of being moved as a unit and it saves handling. To our mind the greatest opportunity for the practical applications of principle No. 2 in the foundry is on the molding and pouring floor. More tons of material are handled in molding, pouring and shaking out than at any other stage in the process of making castings. There is a possibility of applying material handling to these operations in such a way as to make the department almost automatic. We have seen equipment at different foundries which if brought together in one plant would make practically an automatic foundry. One foundry in southern Illinois employs an automatic molding machine that receives an empty flask at one end. The flask travels through this machine, the drag first and the cope following, the sand is first applied and rammed, then the pattern is drawn automatically after which the cores are set by hand and the flask closed. This molding machine produces 80 complete molds per hour, 3 by 4 feet containing four different castings.

Another foundry in Pittsburgh has efficient means of shaking out a flask and returning the empty flask to the molding machine without rehandling. A plant in New York state has installed an automatic system of conveying castings from the shake-out to an incline rattler 30 feet long that receives the castings at one end and discharges them at the other end without the aid of a man at any point. A number of foundries are so equipped that the flask is removed from the molding machine and conveyed to a point adjacent to the cupola or furnace where it is poured.

Bringing Equipment Together

With the proper use of material handling machinery we believe it is possible to bring all of these automatic operations together in one plant. If this principle can be applied to one foundry it will mean that in addition to the men required at the molding machine only a few men will be needed to deliver clean castings to the finishing floor or shipping department. One or more men will be required at the cupola or furnace to take care of the pouring and one man at the shake-out to

lend a hand if castings stick or if flasks do not separate as they should.

To complete this picture the foundrymen should supply a spout or reservoir at the cupola or furnace to permit molten metal to run directly from the furnace into the flask, that is brought to the furnace or cupola on the conveyor. This device should be so constructed that the metal will pour from the bottom something on the order of a steel foundry ladle and have a reservoir above to permit slag to collect where it can be skimmed off. With such a device a mold can be propelled under the spout and brought to rest until poured and then started in motion again. Such an application for the molding and pouring floor would be applying principle No. 2 in an efficient manner.

Most foundries want to get the metal into the molds as hot as possible, particularly the malleable and brass foundries. We don't know of any way in which this can be accomplished with greater efficiency and with greater assurance that the metal will reach the mold hot than by pouring the molds right from the furnace. Foundrymen will say that automatic or semiautomatic molding, pouring, shaking out and cleaning is impossible to accomplish in a practical way in spite of the figures of material handled to produce one ton of castings.

We have been in foundries where thousands of dollars have been spent for material handling machinery and where the owners pride themselves on the fact that they have applied material handling machinery to every operation, but the material handling machinery consists of a hoist here, a monorail system there and a roller conveyor or slat conveyor at various points about the plant. They applied material handling machinery to the handling operations but they did not eliminate the handling operation or they did not apply principle No. 2 as effectively as they might have done. The result is that the material handled to produce castings was still high and the payroll per ton of castings was not materially reduced, although the physical labor involved in producing the castings was reduced to a material extent.

Charles B. Officer, formerly assistant to the president on engineering, Sullivan Machinery Co., Chicago, has been appointed chief engineer in charge of new machinery and changes in design.

Automatic Machines for Small Castings

Question: Do you know of any automatic machines for the production of castings in iron, bronze, brass and aluminum.

Answer: Your question is rather difficult to answer on account of the promiscuous manner in which terms are used in the foundry industry. If you want to know if there is a truly automatic machine in the proper sense of the word which takes molten metal at one end and turns out finished castings at the other end, then the answer is *no* so far as iron is concerned, and *yes* to a comparative extent for nonferrous metals.

The only type of machine that merits the term automatic is the die casting machine made by several manufacturers. The commercial range of these machines, up to the present, has been limited to low melting alloys. In these machines the metal is melted in a pot which forms an integral part of the device and is pumped into the dies under pressure.

In several installations brass, bronze, aluminum and iron are poured into metal molds, but the device scarcely could be called an automatic machine. The metal is melted in a furnace entirely removed from the molds. It is taken from the furnace in ladles or crucibles and is poured into the molds. The molds are opened and closed automatically or by an attendant.

In several instances split molds are mounted on a revolving table which through the action of a cam opens and closes the series of small molds. Even with this machine, attendants have to place the cores and pour the metal. Machines of this type have been described in former issues of THE FOUNDRY.

Book Review

Industrial Safety Organization, by Lewis A. DeBlois, 328 pages, cloth, 6 x 9 inches, published by the McGraw-Hill Book Co. Inc., New York, and supplied by THE FOUNDRY, Cleveland, for $4.00 and in London, 2-3 Caxton House, Westminster S. W. 1, for 20s.

Success of the safety movement in any plant rests in the hands of the managing executive. He must set the example for his workmen and continually, by word and deed, see that instructions are followed and orders for safety are carried out. The author formerly was safety engineer for one of the large explosive manufacturers and is fitted well to give a thorough and practical discussion of the fundamentals and basic principles of safety organization. Primarily, the book aims to supply industrial executives and engineers with information about the safety movement and the essential principles of safety work needed for successful accident prevention. Also it aims to provide safety engineers with a technique based on sound and logical principles. The various phases of safety work are covered with methods in use in industrial plants. An appendix containing report forms, form letters to new employes, description of merit rating and other data may be found quite useful to safety engineers.

Hold Open House

Lamb Machine Co., Hoquiam, Wash., held an open shop and an operating exhibit of the work done in the various departments on Oct. 1. In the pattern shop men were making patterns. Heats of bronze, steel and aluminum were poured in the foundry and the various operations in making a mold were shown to the visitors. In the machine shop, grinding machines, lathes, the hydraulic press, and other machines were shown in operation. Frank H. Lamb, president and founder of the company, suggested this method of better acquainting the public and consumers with the industry.

Announce Prize Winners

Results of the guessing contest conducted by the Sugar Pine Sales Co., San Francisco, at the Detroit convention of the American Foundrymen's association, recently have been announced. That company displayed and offered a prize of $25 to the one making the nearest guess to the age of the tree from which the log was taken. The age of the log was determined by John W. Anderson, forestry department, University of Michigan, Ann Arbor Mich., to be 502 years.

An examination of the guesses submitted showed that four persons guessed 500 years and the judges decided that the prize should be distributed equally among the four. The names of winners are as follows: E. J. Ternay, Burnside Steel Co., Cleveland; Mrs. Grace A. Webb, Flint, Mich.; D. H. Macdonald, Wickes Bros., Saginaw, Mich; and John Lloyd, vice president, Royer Foundry & Machine Co., Wilkes-Barre, Pa.

Illinois Mfg. Co., Quincy, Ill., now is completing new buildings 60 x 230 feet and 60 x 100 feet for the manufacture of foundry equipment.

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

CARE AND MAINTENANCE OF WIRE ROPE

HOW TO SPLICE WIRE ROPE

To prevent appreciable loss of strength at the splice, it is customary to make the splice not less in length than that given in the accompanying table for ropes of different sizes:

Size of Rope inches	Length of Splice feet
½	15
⅜	20
¾	24
⅞	28
1	32
1⅛	36
1¼	40
1½	45

In splicing the two ropes, fasten the ends so that they overlap, allowing for a splice from 15 to 45 feet, as indicated by the table. For purposes of explanation we will assume a 30-foot splice. First wrap or tie the ropes securely with iron wire 30 feet from each end, then unlay all strands 15 feet as shown in Fig. 4, cutting away the hemp core to permit bringing the two unstranded ends together so that the strands will interlock as in Fig. 5.

Take strand *a* and unlay it until the wire binding is reached, then in the open groove place strand *A*. Lay *A* in tightly as shown in Fig. 6, making twist agree exactly with twist of the open groove. Proceed in this way until all except two feet of *A* are laid in, then cut off *a* and *A*, leaving the ends about two feet long. Now unlay strand *B* in the opposite direction and in its place put strand *b*, stopping the ends of the rope in the corresponding position to *A*, Fig. 6.

Subsequently *c* will be replaced by *C*, but this should be stopped six feet short of the junction of *A* and *a*, as shown in Fig. 7. Similarly, *D* should be replaced by *d* and the end stopped six feet short of *Bb*.

Proceed similarly with *Ee* and *Ff*, stopping the ends six feet short of *Cc* and *Dd* respectively.

The rope will now present the appearance shown in Fig. 7 and the only remaining step is to tuck in the ends in such a way that the diameter of the rope will not be enlarged where the ends are tucked in. This is done by removing the hemp center and putting the ends of the strands in the place previously occupied by the core. To do this, it is first necessary to open or untwist strands *Aa* so that the hemp center can be seized with a pair of pliers and pulled out. Then a marline spike is inserted to keep the gap open. After starting the loose ends into the space left vacant by the removed core, rotate the marline spike so as to force the strand into place.

(*Concluded on Data Sheet No. 644*)

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in notebook form.

CARE AND MAINTENANCE OF WIRE ROPE

HOW TO SPLICE WIRE ROPE

(*Concluded from Data Sheet No. 643*)

Upon completion hammer the rope lightly with a wooden or copper mallet, in order to assure a uniform diameter throughout the length of the splice.

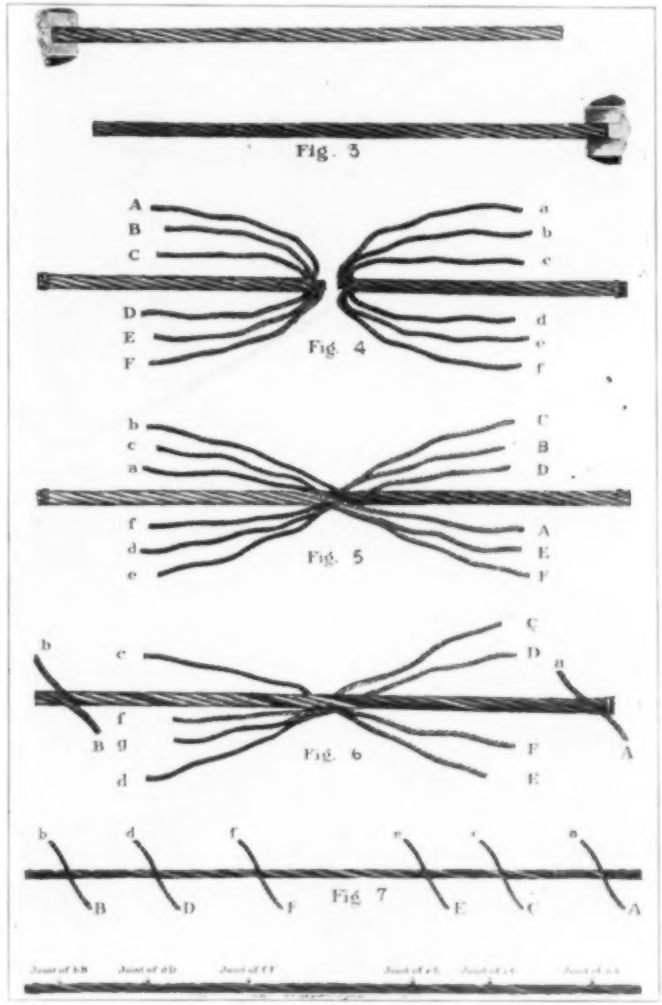
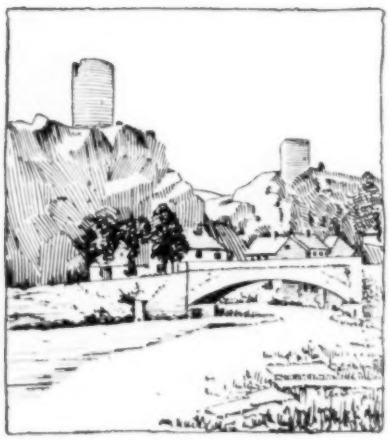


FIG. 3-7—CARE MUST BE EXERCISED IN SPLICING ROPE. FOLLOW THE STEPS SHOWN IN SEQUENCE

Around the World with The Foundry

Little Journeys to the homes of our readers

Luxemburg



AMONG all the upheavals, social, religious, national and political that have convulsed Europe and changed the map so many times during the past 700 years, the little Grand Duchy has remained intact, serene and peaceful as the many streams that flow into the Moselle. A hundred years ago she saw Napoleon's apparently invincible army stream past her southern frontier in a vainglorious expedition into Russia and she saw remnants of the same proud army creep back the following year after pestilence, famine, snow and the wild blasts of winter had taken their toll and strewn the road to Moscow with the bones of brave men who blindly, confidingly and enthusiastically, supported the fortunes of the man of destiny.

In 1914, gray-coated German legions slid past her northern frontier in their initial dash across Belgium and for four long years as the fortunes of war ebbed and flowed, she heard the roar of big guns day and night and saw ghastly, grisly war stalking boldly and brazenly through the territory north, south and east filling millions of graves with young men, literally the salt of the earth.

Outside of Lorraine, once more after 50 years recognized as French territory, Luxemburg includes within its borders the greatest iron and coal deposits in Europe. Naturally in a country where these resources are developed extensively the foundry industry is important and just as naturally THE FOUNDRY is regarded as a standard authority in two of the principal casting plants.

"Wherever metals are cast you'll find THE FOUNDRY"

Pattern Checking Facilitated

Methods of Verification Are Given and Some Easily Made Devices That Aid in Speeding Up the Work Are Included

BY W. N. TUTTLE

PATTERN checking has been a necessary part of the pattern-maker's trade ever since patterns were made, and several plans or systems for doing this have been developed as well as a large number of checking or measuring tools for facilitating the work.

A discussion of this is given in this article, as it seldom is treated as a separate subject in the magazines or pattermaking books.

The first system used, no doubt, might be called the *hit and miss* system, wherein the checker measures all the center distances, and the length, breadth and thickness, or diameter, of all the component parts of the pattern. This, would be all right if nothing ever were missed but if the pattern is anything much more complicated than a block, then doubtless, some dimension will be missed in the checking. Overlooking some erroneous dimension with its subsequent trouble soon causes the checker to drop this easy method and to adopt some scheme to assist him in checking every dimension properly.

Many checkers use what might be called the *reason system*. That is, they think over the mechanical function of each part, to visualize if enough clearance is allowed where rough surfaces of the casting will be near any other part, trying the fit of different parts, measuring all finished surfaces, to see if sufficient stock is allowed, checking up on all holes, etc. This has some advantages, especially if the checker is familiar with the mechanical use of the part, as he would be if he had designed it. This method is used more often by the sample casting inspector.

Some checkers check off the dimensions from the blueprint, taking first all the horizontal dimensions, beginning at the top and going entirely down the print; then all the vertical dimensions; and last, all the angling dimensions. The blueprint is not lettered up with check marks by this method. However, if the checker is interrupted, it is hard for him to tell where he has left off.

The plan which has been adopted more generally than any other, however, is to check off every dimension, note, or symbol on the entire blueprint, with some form of crayon or pencil which will leave a very plain mark, but which easily can be erased after the checking is completed.

A yellow pencil is sometimes used, making all corrections with a red pencil. This is good except the marks are too hard to erase, and make the blueprint untidy and hard to read if left on. Common white chalk is quite satisfactory as it makes a plain mark and easily is erased.

The writer, however, has found that artist's charcoal is a most satisfactory marking medium as it makes a pleasant mark, plain and black, and erases with a cloth eraser (like a blackboard eraser) almost as if by magic.

All dimensions which check O. K. are underlined with a heavy black mark, while dimensions which are wrong are circled with the corrections —as +1/32 or —1/16 as the case might be. After the checking is finished, the pattern with the marked blueprint is returned to the pattern-maker who made it, for correction. When the corrections are checked, the whole blueprint is cleaned, and is left practically as clean as when received. Should it be desired to leave the charcoal markings on until after the castings are made, it may be done, as the markings will remain indefinitely if not rubbed.

In this system of checking, special care must be used to note all dimensions which may be used for more than one pattern part, lest this part be overlooked altogether.

Since most standard patterns are made in metal and as castings generally do not agree exactly with the pattern checking, it usually follows that three or more checks are made from each blueprint:

First, the double shrinkage check on the master pattern, which should be made carefully for draft and core fits, as well as for dimensions.

Second, the metal pattern check,

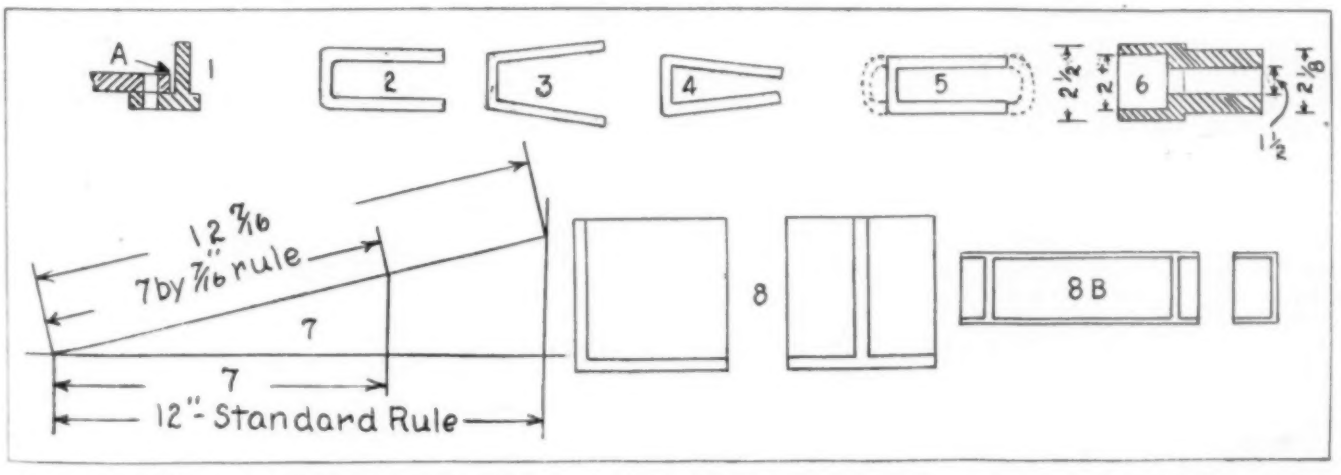


FIG. 1—ALLOWANCE FOR ROUGHNESS MUST BE MADE TO HAVE HOLES LINE UP. FIGS. 2, 3, 4 AND 5—IMPROPER GATING CAUSES DISTORTION OF CASTINGS. FIG. 6—METHOD OF HANDLING SPECIAL DIMENSIONS. FIG. 7—TRIANGULAR METHOD OF OBTAINING SHRINKAGE ALLOWANCE. FIG. 8—ANGLE PLATE IS FINISHED ON ALL SIDES. FIG. 8B—CAST IRON PARALLELS SHOULD BE LIGHTENED

with the single shrinkage rule. This may be rather superficial, compared to the first and third, noting chiefly if anything be omitted. However, careful core fitting checks should be made in the second check, to see if the prints fit and the dimensions total up properly. Corebox checks should be made in just the same way that the cores set or pile up in the mold, rather than from the center line distances, as is done more often in the pattern check. The centerline dimensions might be all O. K. in the corebox parts yet variations between the pattern and corebox prints might throw the core parts entirely out of position in the casting.

Third, the casting check, which also should be very carefully made. Sample castings should not be run through the tumbling mills but should be sand blasted, leaving on all fins, so that the core fits may be observed. The casting should be inspected carefully for crushes, dirt, fins, etc., before checking, to see where these are due to pattern faults.

In making the casting check, it is generally best to paint over the casting either in whole or in part, with a white checking paint, made of dry white lead and alcohol, with a slight amount of shellac to make it stick better. After the casting check is made, noting all discrepancies on the blueprint, and trying all fitting parts if there are any, the designer should be called, who looks over the castings. He considers all the discrepancies checked on the blueprint and decides which should be corrected and which would be harmless.

It generally happens that variations have to be made from the theoretical pattern dimensions to obtain the required casting dimensions. However, the pattern alterations should not be made until investigation proves the variation is not due to carelessness in the molding or core making.

The pattern foreman finds from experience that he often can foresee where the pattern must be made different from dimensions in order to get castings like the blueprint. In these cases he should mark the print before the pattern is started.

For example: All green sand holes, as bolt holes, should be made 1/32-inch oversize in the pattern, and measured on the small end of the hole; all gears, sprockets and all small castings which must not run oversize should be made about 0.02-inch smaller than correct dimensions; backlash in rough cast gears about four per cent more than desired in the castings; bolt holes which are measured from a rib or casting edge where the castings abutt, should be laid out about 1/32-inch further from the rib or nearer the edge than the blueprint calls for. This will be seen in Fig. 1, where allowance for the roughness at *A* on both castings must be made in order to have the holes line up. Some patterns must be bent in order to get straight castings. This subject is treated well under the heading of *Camber* in most patternmaking books, and will not be elaborated upon here.

It might be stated that in many cases it is impossible to foretell these variations, no matter how great the experience of the patternmaker, and only be found by trial. Even then a change in the gating, pouring temperature, etc., may upset his previous calculations and call for change.

The writer well remembers making a pattern for a steel casting like Fig. 2, about 10 inches long, 3 inches wide and ¾-inch metal thickness. The sample castings came like Fig. 3; whereupon the pattern was called in, altered like Fig. 4 to compensate for the distortion, and returned to the steel foundry. A year's supply of castings soon came in, exactly like the pattern after it was altered, Fig. 4.

In explanation, the first castings had been gated at *A*, Fig. 5, while the second order was gated as at *B*. Numberless similar experiences might be cited by anyone long connected with this line of work, but sufficient already has been given for illustration.

Ordinarily more variation allowances have to be made in gated patterns than in match plates, although it is probably possible, with the best of molders, patterns and care, to make better castings from gates than from match plates. But in general practice they probably do not average up as well, due to the match plates not being rapped.

It is understood that the patternmaker often has to make the pattern somewhat different from the blueprint where accuracy of the casting is required, and the draftsman can be of great assistance by marking special dimensions which should not be increased or decreased from the print. One way to handle this is shown in Fig. 6, in which the right hand arrow-head has a plus or minus symbol to indicate which way the patternmaker should hold his dimensions. The 2-inch dimension, marked ←2+→ must not be allowed to run undersize, as something fits into this hole; and likewise the 2⅛-inch must not run oversize, because something fits over the casting. A slight variation would be permissible in the other dimensions. The patternmaker would make the marked dimensions about 1/32 inch over or under size to allow for casting variations, while the remaining dimensions would be followed directly.

In some drafting rooms a patternmaker's tolerance is marked on all these critical dimensions; in others an

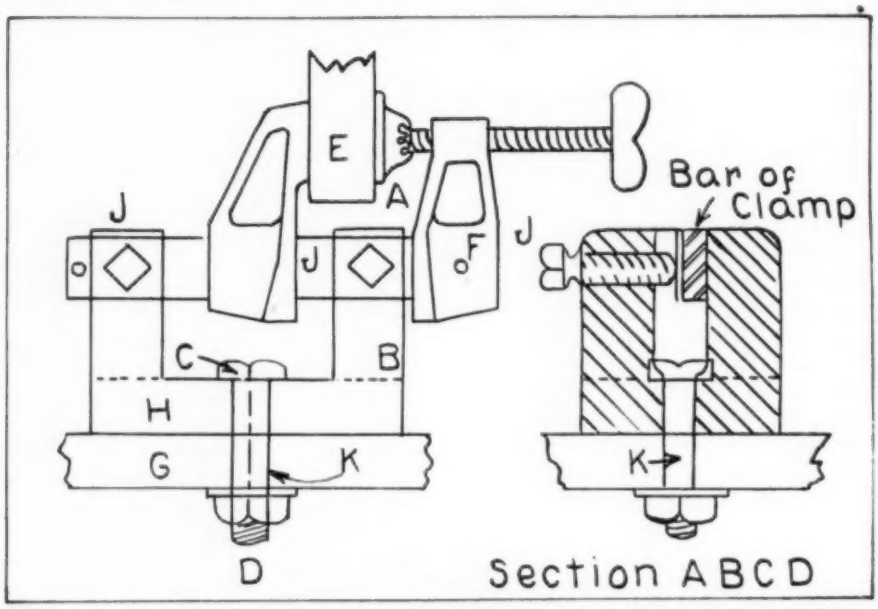
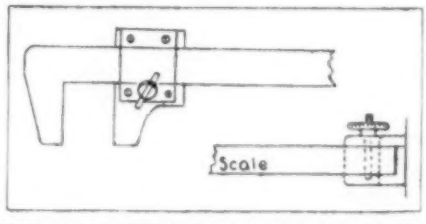


FIG. 9—AN IMPROVED CLAMP AIDS IN CHECKING THE THREE PLANES OF THE PATTERN BY SIMPLE ADJUSTMENTS



FIGS. 1-10—SKETCHES OF VARIOUS TYPES OF CASTINGS WITH HOLES THAT THE AUTHOR ATTRIBUTES TO GAS DEFECTS

exponent or symbol, while in others, notes are given. Whatever system is used, it is a great help to the patternmaker and an improvement over the usual plan of letting him guess at it.

Occasionally a pattern is needed for which there is no shrinkage rule in the shop. Either the *diagram* or the *constant* method may be used. For example, it might be found that a double shrinkage for aluminum and steel were 7/16 inch, with no available rule. A diagram like Fig. 7 might be drawn, in which the base line would be made 12 inches by the standard rule. The hypothenuse should be located so that it measures 12 7/16 by standard rule. Then any required dimension, as 7 inches could be measured on the base line by standard rule, squared up to the hypothenuse which will give the same dimension as on the 7/16 inch shrinkage rule. By the *constant* method:

$$\frac{12.4375}{12} = 1.036 +$$

Adding the desired shrinkage to 12 inches (equals 12.4375) divide by 12, which gives the length of a 1-inch measurement on the 7/16-inch scale. Any desired dimension, multiplied by 1.036 will be the dimension allowing for the 7/16-inch shrinkage. This is convenient when the pattern is to be finished in the toolroom, as the toolmaker can use his *mikes*, and is less confusing to him than the shrinkage rule. Where much work is done in the toolroom, constants should be computed and kept on file for all the standard shrinkages, so that the dimensions readily may be altered.

For the standard ⅛-inch shrinkage for cast iron, an easier method (an adaptation of above) consists in placing the dimension down twice, one dimension *set over* two integers and added, thus:

$$\frac{32.75}{33.0775} = \text{Standard rule for } 32\tfrac{3}{4}$$

inches by ⅛ shrinkage rule.

This gives a result of .005 inches per 12 inches, or about .0004 inch per 1-inch undersize, which is generally more accurate than ⅛ inch per foot standard shrinkage, as castings made by the ⅛ rule are usually slightly oversize.

Various tables to be found in the mechanical handbooks, such as the table of polygon sides, of degree chords, of arc lengths, etc., will be found of great convenience to the checker.

A few examples follow: Suppose there are 5 bosses 2 inches in diameter, equally spaced on a 16-inch circle. By multiplying the polygon constant for 5 by 16 and adding 2, the calipers may be set to this dimension and the equality of spacing, diameter of boss centers, and diameter of bosses may be all checked at once, since an error of any one of these would show in calipering over the outsides of any two bosses. This is especially convenient if the center of the boss circle is covered up, and no boss circle scribed upon the pattern.

An arc given on the blue-print in degrees, but inconvenient to check anywhere upon the pattern except upon the periphery easily may be checked by bending the flexible steel rule around the pattern, and reading off the arc length taken from the table of *length of arcs*.

The table of tangents is convenient for laying off angles accurately, by laying off a 10-inch base line, and erecting a perpendicular at the end, marking off the direct reading from the table of tangents for the required angle, only moving the decimal place one place to the right since the base line was laid out 10 inches instead of 1 inch. The angle between the base and hypothenuse will be the required angle. Great accuracy is obtained by multiplying the dimensions by 10.

One degree angle at a radius of 7 5/32 inches equals a ⅛-inch chord. This may be used for checking small angles up to 15 degrees with negligible error.

Center distances between two bosses or shafts whether of equal or unequal diameters, may be found by adding the *between* and *overall* calipering and dividing by two. Thus, Fig.

$$14\ C = \frac{A + B}{2}$$

The tables of specific gravity, areas of circles, pipe sizes, bolt and nut sizes, expansion tables and alloy tables are all of more or less frequent use to the checker, and a liberal use of the technical books will increase the ease of his work.

Where there is much checking to be done, a convenient set of checking

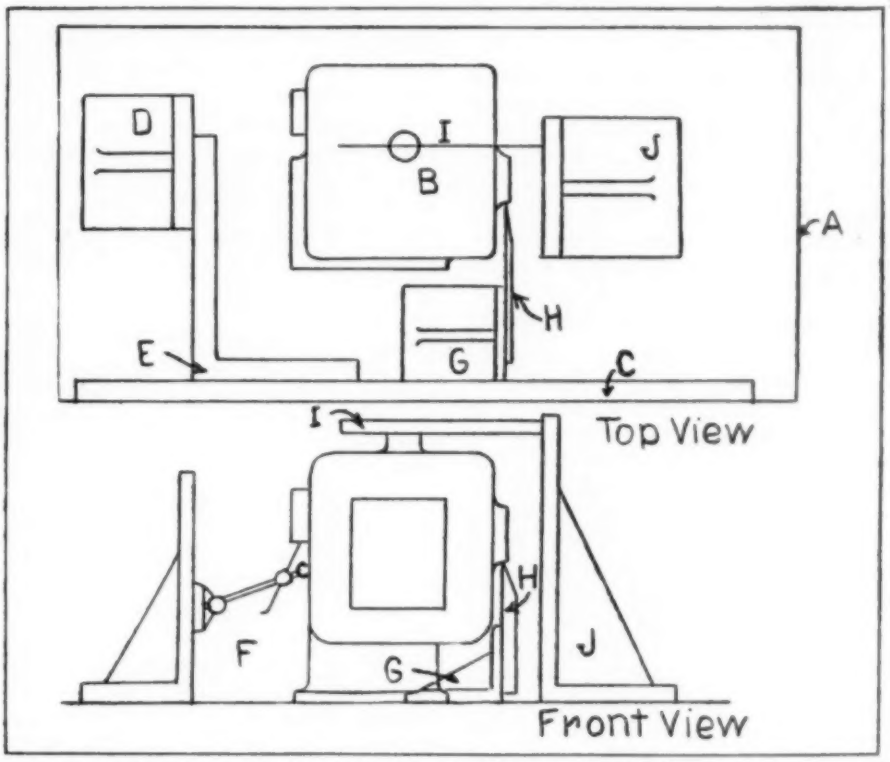


FIG. 12—CHECKING OF HEAVY SAMPLE CASTINGS IS FACILITATED BY USING THIS SURFACE PLATE BY WHICH CHECKS OF SEVERAL POSITIONS MAY BE MADE AT ONE TIME

tools is profitable, if not an actual necessity.

First, comes the iron surface plate, angle plates and parallels, surface gage and depth gage, accompanied by the squares, calipers, scales and other tools which are a part of the patternmaker's personal tools.

The angle plate should be made as shown in Fig. 8, which is finished so as to *set square* on any of its six sides.

An ordinary wood handscrew may be clamped to this with a *C*-clamp. Small pattern or castings may be clamped in the handscrew, and adjusted so that by turning the angle plate on its three sides in succession, its three planes will be at exactly right angles to each other, after which its entire checking can be made with simply the one setting or clamping.

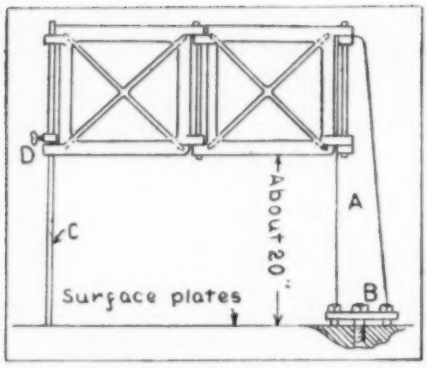


FIG. 13—ALUMINUM TRUSS FRAMES FORM A CHECKING MACHINE THAT MAY BE USED AS A SQUARE, DEPTH GAGE AND SURFACE GAGE. THE ROD EASILY CAN BE PUSHED OUT OF THE WAY OR USED AS IS NECESSARY

A much more convenient clamp to use with the improved angle plate is shown in Fig. 9. This is a casting *H*, about 3 x 6 x 2½ inches, milled out so as to hold the standard bar clamp *F*, by means of the two setscrews *JJ*. The pattern or casting to be checked is held in this clamp, as at *E*. The casting *H* is bolted to the angle plate *G* by one bolt in its center, as at *K*.

The pattern can be adjusted in one plane in the jaws of the clamp *F*, in another by twisting on the bolt *K*, and in the other by tapping the clamp down on one end of the other in the milled slot, where the clamp is held by the setscrews *JJ*. After the pattern is adjusted in its three planes, it can be checked by rolling over the angle plate in its three planes, without further adjustment of the pattern. In case of a large pattern, it may be placed upon the surface plate, and held in any position by means of this angle plate and clamp.

An old machine tool vise, with four setscrews in the base, makes a convenient holder for checking rather heavy castings, the setscrews in the base being used for leveling or squaring up the casting. Cast iron parallels should be lightened, as shown in Fig. 8*B*.

A half-dozen posts about 4 inches long by 1¼ diameter, all of exactly the same length, are often of great convenience in checking. Also a few pairs of small parallels, made of cold rolled, ¼-inch squares, ½-inch squares, 1-inch squares, etc., steel.

A large size depth gage, made of a hardwood bar, with a depth bar of ½-inch drill rod, held in position by a setscrew is convenient. Also a pair of stoveplate pattern thickness calipers.

Sometimes it pays to make a special tool to take one special measurement, where this is done often. Such a tool is shown in Fig. 10 which was designed for measuring the length of the hubs and core prints of split iron pulley patterns. This may be slipped down between the spokes of the assembled pattern, and these measurements easily taken, eliminating the depth gage or transfer calipers, and the turning over of the heavy iron patterns.

The scale holder, shown in Fig. 11, which may be made or purchased, is a great convenience, used with the surface gage, as any desired point on the pattern may be transferred to the scale, adjusting same to the nearest 1-inch mark, from which any other measurements may be readily taken off the scale on to the surface gage. This is also useful in the making of the patterns.

A few wedges, tool room jacks, blocks and 10-cent store clamps are also useful around the checking table. In checking the *match* of matchplates, the standard *hairpin gage* is generally used, but for more accurate checking, the pattern should be painted and the surface gage used, extreme accuracy being obtained by noting where the surface gage just scatches the paint. In some cases a tool room indicator is attached to the surface gage, which will thus show in thousandths the exact amount of mismatch. It is essential, of course, that the matchplate be clamped in a perfectly vertical position before checking.

Sometimes the matchplate will be a little thin next to the pattern, which will cause a slight *crush* in the mold, causing a mis-match in the casting which does not check up on the pattern. This is sometimes baffling to find.

Where much surface gage work is to be done, it is a great luxury to have the thumb nuts enlarged to at least double their purchased diameter. This relieves the fatigue and soreness of the fingers in repeated use.

In checking heavy sample castings, it is often quite a task to turn them over several times in the checking. Fig. 12 shows how they may generally be checked in one setting, shows the surface plate, with the steel scale *C*, securely clamped along the front edge. *B* is the top view of the casting to be checked. Heights may be measured most conveniently with the surface gage and scale holder, or with a toolmaker's height gage. *D* shows an angle plate, located at a predetermined lateral position by means of the flat square *E* and the steel scale. *F* shows the surface gage in getting lateral dimensions from the angle plate. Another angle plate is shown at *G*, adjacent to the steel scale, from which a lateral measurement is transcribed by means of the pointed steel straightedge scriber *H*. *I* shows a steel scale as used in taking a lateral measurement from the angle plate *J*. A straightedge may be clamped to the rear of the table, parallel to the scale on the front edge, for obtaining measurements on the rear of the casting.

Fig. 13 shows the front view of a checking machine developed by one of the patternmakers, and now in use in the shop in which the writer is employed. A standard *A* is bolted on the rear of the surface plate by one cap screw *B*, and adjusted by four setscrews shown. The two trussed frames are made from the same pattern, being cast in aluminum, of about ¼-inch thickness. The hinge pins are of drill rod. In each frame one hinge pin or drill rod is placed in a reamed hole, directly machined to size, with the hinge lug split and clamped with a capscrew. The other drill rod is babbitted in position, this being done to obtain extreme accuracy with little trouble. *C* shows a ½-inch drill rod, made an easy sliding fit in its adjustable lugs, so that it will hold its weight in any position. This rod can be swung over practically the entire area of a large surface plate, the end of the rod running always parallel with the surface plate, and the rod always square with the same. Thus it can be used as a square, depth gage and surface gage, can be pushed back out of the way instantly and as readily brought back to use. This device is useful for checking draft, especially in holes, around bosses, etc., and does not require the clearing of a clean place.

The set collar *D*, is used when getting a depth gage measurement which cannot be read easily otherwise. It was feared in the making of this that the sag of the instrument in its various positions would materially injure its usefulness. It has been found, however, that 4 or 5 thousandths in 12 inches is the extreme limit of its inaccuracies.

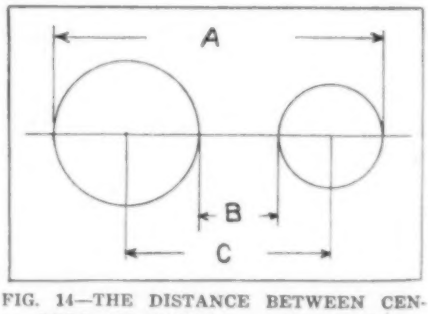


FIG. 14—THE DISTANCE BETWEEN CENTERS OF BOSSES IS THE MEAN BETWEEN THE OUTER AND INNER EDGES

How and Why in Brass Founding

By Charles Vickers

Alloy Will Meet Test

We want to make an aluminum casting with a tensile strength of 30,000 *pounds per square inch. What alloy will give us this strength? Also tell us what is duralumin?*

The following alloy will be what is desired: Aluminum 73.50 per cent; copper 3.50 per cent; zinc 23 per cent. Make it by melting together 70 per cent virgin ingot aluminum and 7 per cent of a *hardener* consisting of 50 per cent copper and 50 per cent aluminum, and when thoroughly liquid add 23 per cent zinc of high grade. Do not allow the melt at any time to rise above a dull red in color, and pour as cool as it is possible to get a satisfactory casting. In sand-cast test bars this alloy has given between 33,000 and over 35,000 pounds per square inch tensile strength with better than 20,000 pounds, yield point. The elongation, like so many aluminum alloys is little better than 1 per cent.

Duralumin consists of copper from 3 to 4.5 per cent; magnesium from 0.4 to 1 per cent; manganese from nothing to 0.7 per cent; remainder aluminum.

It is not an alloy that will give anywhere near 30,000 pounds tensile from a test bar made in molding sand. The alloy given above may be expected to meet the specifications, provided it is handled properly.

Makes Stronger Alloy

We are making a manganese bronze metal that is used principally for casting chain links that require a high tensile strength. The composition we use follows: Copper 63 *per cent; zinc* 33 *per cent; aluminum* 3 *per cent, and manganese copper* 1 *per cent. We get a tensile strength of about* 50,000 *pounds per square inch, with an elongation of* 5 *per cent. Do you know of an alloy that will be better than this?*

Manganese bronze always is made by first preparing an alloy containing the iron, manganese and tin, when tin is used, then melting that with the copper and afterward adding the zinc. However, a simple manganese bronze may be made to the following formula: Copper 66.50 per cent; zinc 28 per cent; aluminum 3.50 per cent; managanese copper, 2 per cent. The latter alloy should contain 30 per cent manganese. The alloy is made by melting the copper under charcoal, adding the aluminum, the manganese copper and the zinc. When properly made, this alloy will have a tensile strength around 72,000 pounds per square inch; elongation about 27 per cent, or better and will be an improvement over the alloy now being used.

Desires To Use Antimony

We would appreciate any information you can give us in regard to the use of additions of antimony in place of tin in brass mixtures. We understand that tin cannot be eliminated entirely but think likely we can reduce it in such mixtures as 88-10-2 *and* 80-10-10.

While antimony may be used in small amount in red brasses to replace tin, its addition to alloys such as those mentioned in the query means a large reduction in the physical properties of the alloys in question, while the saving is not of great moment. The effect of antimony on copper alloys is an embrittling one, and if one, or at the most 2 per cent antimony is added to the 88-10-2 alloy, for instance in place of the same amount of tin, the properties of the alloy will be so changed, that an ordinary red brass would be just as good. If the 80-10-10 alloy is to be superseded by alloys lower in tin, but of good physical properties, a saving can be effected that is perfectly legitimate. It will depend largely on what the castings are, but unless hardness in an important factor an alloy of copper, 90 per cent; tin, 6 per cent; zinc, 3 per cent and lead, 1.5 per cent, may be used.

Unless the 80-10-10 alloy is to be used for castings to withstand heavy loads, or pounding, then the alloy: Copper, 78 per cent; tin, 7 per cent; lead, 15 per cent, will give even better service than the more expensive alloy.

Antimony seldom is used even in ordinary red metal now, as a considerable saving may be effected by the use of ingot metal in place of virgin metals for red brass, and there are makers of such ingot who may be relied upon to furnish exactly the metal that is paid for.

Wants Data on Flues

We are building solid fuel brass furnaces and would like to know something about the flue. The pit is 6 *feet deep, and the flue* 19 *inches wide. Would it be any advantage or disadvantage if the flue were carried the full depth of the pit? Would it be necessary to carry the full depth of the flue right into the stack? Would the stack be weakened by doing this?*

Provided the flue is made airtight it will be no disadvantage to carry it to the depth of the pit. It will be necessary to tie the two walls of the flue together so there will be no bulging later on. As the furnaces work, the space between the two walls will fill up gradually with debris from the fuel, zinc oxide and possibly bits of metal, but with a deep flue, such as the one mentioned, this will take years of accumulation. A good pit for such furnaces usually is made with walls of concrete, and with a bottom of the same material, deepened under the stack to provide a solid foundation. The nature of the ground, of course governs the size and thickness of the concrete footing for the stack, and the height of the latter also has to be considered.

The stack would be weakened by carrying the flue down to the foundations. Therefore this is not desirable, although the flue must not be choked where it enters the stack. The flue should be carried its full width into the stack, but shortened from the floor. The area of the flue should not be less than 100 per cent greater than the combined area of all the furnace flues entering it, to avoid friction of the gases which would check the draft of the fires. Sometimes the flue is carried on top of a concrete wall, cast at the same time as the walls and bottom of the pit. Such a wall need not be solid as hollows may be filled with earth. It may be three feet high to save brickwork, and where the furnace openings are several inches above the top of this wall, it is not even necessary to floor the flue with firebrick. In building the firebrick flue lining, bond the fireclay with silicate of soda. Even the most perfect flues are of little use without a good high stack to cause a draft.

Watch Your Grinding Costs

Many Factors Must Be Considered to Obtain Maximum Production With Minimum Expense—Expert Supervision Shows on the Profit Sheet

By C. C. Hermann

MAXIMUM production at minimum expense of wheels and labor should be obtained in foundry grinding operations. The same considerations apply as in any other grinding operations, the variation being a matter of degree only.

Efficiency as applied to rough grinding operations may be summed up briefly as follows:

It is important that the proper selection of grade and grit of wheel for the work at hand be made. For example, grinding white iron or hard iron previous to annealing requires an entirely different grit from that which the same castings will require after they are annealed. The wheel grit will be different from that used for gray iron castings and the grit and grade will vary for different wheel speeds or peripheral speed. Therefore it is paramount that some clear knowledge should be had regarding the action of different wheels when applied to different work and at different speeds.

Speed, that is, peripheral speed of the wheel becomes an important consideration and affects the efficiency of the wheel. Peripheral speed is a function of the diameter and at this point other factors must be taken into consideration, namely; wheel diameter and of almost equal importance with wheel diameter, the thickness of the wheel. However, this factor depends more upon the class of work than upon any other consideration.

Several factors affect the efficiency of the wheel in operation namely; *a*, balancing; *b*, trueing; *c*, dressing, and *d*, vibration. Vibration is an enemy of grinding wheel efficiency and causes more loss with increased wheel cost than any other factor. This is particularly true of foundry grinding, primarily due to the lack of competent supervision. The wheel wobbling at high speed delivers thousands of sledge hammer blows per minute on its grinding surface. A dangerous condition as well as inefficient.

A test of two different grades and grits of wheels was conducted by the writer during an investigation. The work produced by the two wheels was as nearly the same type as it was possible to obtain. The wheels were run on the same spindle and at the same spindle speeds. Due to one of the wheels being slightly larger when put on, there was a slight difference in the peripheral speed of the wheels, but this difference was not sufficient to cause any material variation in the results. The work consisted of rough grinding or snagging gray iron castings. The results are shown in the accompanying table. The grade of wheel *A* corresponds to a medium hard and although slightly under wheel *B* in peripheral speed shows a lower cost per man hour of production, based on the weight of work produced. Wheel *B* was also slightly heavier and corresponds to a medium soft grade. Due to its softness, the reduction in weight of the wheel was greater than with wheel *A*. The amount of metal removed per pound of grinding wheel weight was 68.6 per cent greater with wheel *A* than with wheel *B*. However, the reduction in wheel diameter is almost the same. This is due to wheel *B* glazing over readily, resulting in considerably more dressing of the wheel which made it cut more rapidly but the amount of grinding medium removed by dressing was excessive. Wheel *A* is a more efficient wheel for the work than wheel *B*, although the efficiency of wheel *B* could have been increased by increasing its speed to around 5500 feet per minute. This would only be an emergency change as speeds above 5500 feet per minute are not recommended for rough grinding and snagging. It would be better judgment to select a slightly harder grade. The grit used in wheel *B* is slightly coarser than in wheel *A* and this accounts for some of the reduction. Larger grains are more easily dislodged from the face of the wheel than smaller grains and the possibility of soft spots in the wheel is greater with the larger grain.

Select The Proper Type

The proper selection of the grade and grit of grinding wheels cannot be too emphatically stressed. In some of the factories encountered by the writer, the grinding department foreman is not consulted in purchasing, consequently his experience with different clases of wheels is lost to the company. By close co-operation between the purchasing department and the foreman or superintendent of production departments, many errors in purchasing may be eliminated. A close study by the engineer in charge of production, more than pays for itself. Where such services are not available an outside engineer should be consulted as expert advice is an investment that pays good dividends.

Peripheral speed of the wheel face influences the efficiency of the wheel as stated previously. The speed of the arbor is only incidental to maintaining the peripheral speed. Where large wheels are used and the arbor is not provided with variable speed control, arbors of different speeds should be provided. When the wheel diameter has been reduced to a point where the peripheral speed of the wheel is below 4000 feet per minute, it should be removed to another arbor having a speed sufficiently high to bring the peripheral speed up to 5500 feet per minute. Speeds of 6000 feet per minute are in use where the work is held rigidly and where the feed of the work to the wheel is under control. For rough grinding and snagging the maximum speed is about 5500 per minute.

A grinding wheel must be mounted properly to make it safe in every way. Flanges must be of proper diameters for the corresponding diameter of the wheel and changed to smaller diameters as the wheel wears down. The operator should never attempt to save time by skipping a set of flanges making a larger reduction in flange diameter than should be the case. Another thing that should be watched carefully by those in charge of grinding work, is that the flanges used are of the same diameter. Once in a while some of the flanges are misplaced and two flanges of the same diameter cannot be located in a moment. The consequence is that flanges of different diameters are taken. The effectiveness of the flanges is no greater than that afforded by the smaller flange.

In fact flanges of different diameters take a bearing on different points of the wheel causing an unnatural stressed condition to exist and may cause bursting of the wheel.

Wheels should be amply guarded by a strong hood. The writer has seen hoods made out of sheet steel extending from some support above the wheel and projecting slightly forward and without sides. Such hoods are no protection. This is a matter that is generally controlled by state law and it is a matter that every one responsible for grinding departments should look after without the necessity of law regulation. Hoods are a bother sometimes but they are such vital protection that the bother should be forgotten. See that the side of the hood is replaced after changing wheels or flanges. The hood side is often laid aside and forgotten. The best way to regulate the replacement of the hood side is to secure the side to the hood by a chain or better yet by hinges. The hood should be adjusted occasionally so that the forward edge is the proper distance away from the wheel. This is important from the standpoint of safety as well as to facilitate getting the work close to the wheel.

All wheels presumably are balanced before being shipped by the maker. Where a balancing-way is available, no harm is done by checking the balance before placing the wheel on the arbor. The maker balances the wheel by inserting lead near the hole of the wheel. This balance is within narrow limits and seldom can be improved upon in the average shop. After the wheel has worn down somewhat, the balance may be off and can be corrected readily by removing sufficient lead.

Balance Is Important

A wheel out of balance is a bad state of affairs both from the safety standpoint and from the rapidity of wear. Imagine a situation where there are just a few ounces too much weight on one side of the wheel near the periphery of the wheel, and revolving at a speed of 5500 feet per minute. It would exert a pull on the arbor sufficient to spring the arbor due to the centrifugal force. As the high point comes around to the work held in the workman's hand the arbors bend and buckle thousands of times per minute and you have a picture of the likelihood of the arbor snapping off and sending the heavy emery wheel through the shop perhaps killing or maiming several workmen. Again imagine every time that the high spot comes around to the work, a sledge hammer blow is dealt the wheel, and if a crack does not develop across the wheel thereby resulting in the loss of the wheel, certainly its life will be materially decreased due to the pounding off of small particles of emery.

Outlines Work for the Foundry Physicist

Experience is one of the average foundryman's greatest expenses, yet in nine cases out of ten this is thrown away according to R. R. Clark, superintendent of the alloy foundry, General Electric Co., Erie, Pa., who spoke at the October meeting of the New England Foundrymen's association at Boston. Experience, according to the speaker, should be capitalized. In this way it changes from a liability to an asset. Knowledge becomes useful only when reduced to fundamental principles. Knowledge about molding practice should be analyzed and boiled down to its essence. All molding phenomena comes under two general classification, 1. physical and 2. chemical.

A foundry physicist is perhaps a visionary individual at the present time, according to Mr. Clark, but he surely is destined to materialize before long. Foundry chemists have demonstrated their value to the castings industry, and it is now up to the foundry physicist to make a like demonstration. The cause of most defective castings can be traced to a physical rather than a chemical origin. The foundry physicist should apply certain fundamental principles, such as the hydro-static laws, to the practice in the foundry. If hot metal drops upon a flat surface, it spatters. If it drops onto a concave surface, it does not scatter as much, and if it drops into a pool of hot metal, the trouble is reduced to a minimum. This is one of the principles which should govern the design of gates.

Another principle is that of radiation. A round gate has more volume for the amount of surface than a square gate, and a square gate has more volume than a flat gate. Therefore if the metal in a gate is to remain molten until after the casting itself freezes, a round gate should be used. If it is desired to have the gate freeze first, then a thin flat gate is best.

The meeting was well attended. Henry Blumenauer, president, gave an account of the dinner to the foreign foundrymen at New York, to which he was a delegate from Boston. A representative of the Wentworth Institute of Boston gave a brief outline of the two foundry courses, the one year course and the two year course given at the Wentworth Institute, and entered an appeal for more general interest in these courses and for more students. The courses have been running for 15 years with no increase in enrollment. Boys starting a course in special training seem to prefer any other branch to foundry work. This is thought to be largely prejudice which can be overcome by educational methods.

Results Obtained Using Different Wheels on Same Class and Type of Work

DATA	WHEEL A	WHEEL B
Grade of wheel	R	1½
Grit of wheel	16	14
Mean dia. of wheel on	23 inches	24 inches
Mean dia. of wheel off	23 inches	23 inches
Weight of wheel on	84.25 lb.	100.5 lb.
Weight of wheel off	79 lb.	91.36 lb.
Reduction of wheel diameter		1½ inches
Reduction in weight of wheel	5.25 lb.	9.137 lb.
Time observed	32.83 hrs.	31.667 hrs.
Actual number of pieces ground	2,038	2,739
Actual weight of castings ground	22,035 lb.	20,540 lb.
Average weight of castings ground	10.86 lb.	7.5 lb.
Amount of metal removed	150 lb.	155 lb.
Amount of metal removed per casting average	.0736 lb.	.0566 lb.
Weight of emery removed from wheel per pound of metal removed	.035 lb.	.059 lb.
Weight of metal removed per pound of emery removed from wheel	28.6 lb.	16.96 lb.
Pounds of castings ground per man hour	671.2 lb.	648.6 lb.
Labor rate per man hour	$0.35	$0.35
Cost per hundred pounds of castings, labor only	$0.052	$0.54
Speed of machine arbor, revolutions per minute	850	850
Peripheral speed of wheel, ft. per min., maximum	5,292	5,382
Peripheral speed of wheel, ft. per min., minimum	5,132	5,132
Mean peripheral speed, ft. per min.	5,212	5,257

Buffalo Forge Co., Buffalo, has appointed Leon E. Haynes as assistant advertising manager. Mr. Haynes has had extensive industrial and merchandising experience in addition to agency copy and contact work.

Bill Demonstrates How Soil Pipe Is Made

By Pat Dwyer

LONG ago Solomon said, three things no man can understand, yea four, the way of a ship in the sea, the way of an eagle in the air, the way of a serpent upon a rock and the way of a man with a maid, or the way of a maid with a man. I have forgotten which, but probably the latter. I am too lazy and comfortable to look up the reference now and really it is only a matter of minor importance. Besides I am afraid if I started scouting through the Book I would become interested in some other chapter and probably would forget the original object of my search.

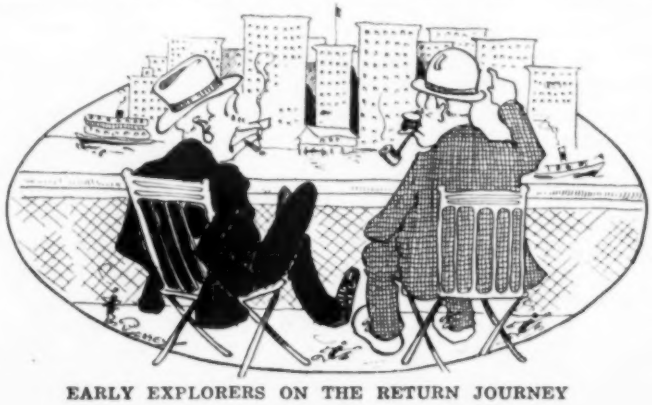
The old boy with his extensive explorations in matrimony and more or less related lines may be regarded as something of an authority in his special field of research. In my capacity as a shy and somewhat diffident amateur I do not pretend to speak with authority on the subject of femininity in general, but so far as experience with my one and only wife is concerned I am inclined to agree with the views of the greatest historical sheik of all time. The way of a maid or of a lady at any other stage of her existence is beyond my understanding.

At one time or another I have speculated idly on the subject and occasionally I have made plans in which I assumed that the party of the second part would play a certain definite role. Almost invariably I have found the plans changed without notice and without the slightest regard to what I may have had in mind. Presumably, if I had been unfortunate enough to select a clinging vine, conditions might have worked out differently. I say unfortunately advisedly, for in that case I should have been forced to do all the thinking for two, while under the present arrangement I only have to do my own limited amount of this wearisome exercise. When the time for the annual convention rolled around as conventions have a habit of rolling around every year I suggested we take the boat Saturday night, spend Sunday visiting friends in Detroit and then do the convention for the remainder of the week. She said the plan suited her. A few days before the great event I brought home the tickets and was told calmly that she had changed her mind. She did not intend to leave home until Monday or Tuesday and I could cancel her reservation.

Bill came in the following night before I had taken any action and when he learned of the situation he gallantly offered to accompany me and share my stateroom on the boat. He had not intended to go until Sunday night, but he said an extra day around the village would not do him any harm. He knows a great many people in Detroit. Also he knows a great many ways of spending an idle day. Good old Bill, a friend in need and all that jolly old kind of piffle. What!

The lady arrived Tuesday morning and entered fully into the spirit of the occasion for three exceedingly busy days. I suggested that it would be a good plan to rest up Friday and then travel home in peace and comfort that night. She said no. So far as she was concerned the convention ended with the banquet Thursday night. She had neither desire nor inclination to poke around Detroit all day and half the night Friday. She intended to go to the boat immediately after the banquet and sail for home. Far be it from me to interfere with the rights and privileges of a duly accredited full partner. Still further be it from me to set up an argument, which although perfectly legitimate according to all the laws of logic and ordinary common sense, still is useless in the presence of a lady who has made up her mind. She changed her mind again when she learned of a dance Thursday night.

Bill and I saw the last dog hung according to schedule Friday and then in the company of a few congenial spirits we managed to while away the remainder of the day and evening until the time arrived for the sailing of the night boat from the foot of Third street. We sat up for an hour smoking, watching the shores of the river gliding by and listening to the hoarse sirens of the big ore boats. Some going up the river empty, riding high out of the water and others going down deeply laden with thousands of tons of red ore from the far away iron ranges at the head of Lake Superior. Great silent monsters slowly plowing their way through the waters, glaring ferociously through a red and a green eye forward, with a single white light at the mast head and with the wheelman the only sign of life aboard, gripping the spokes on the bridge forward of the funnel cocked at a rakish angle far aft. At periodic intervals a deep booming roar of the siren warned other craft to watch their step and keep out of harm's way. A bump from one of these 10,000 or 12,000-ton lads is not to be compared with a coquetish slap from a lady's glove. Yo-ho-ho and a bottle or rum! After the stirring events of the week I was minded to just sit and smoke in peace and



EARLY EXPLORERS ON THE RETURN JOURNEY

silence. My sentiments were in perfect accord with those of the native of the little settlement who was asked by a nosey tourist how the inhabitants spent their time. "Oh!" says this truthful and contented native son, "Sometimes we just sits and thinks and sometimes we just sits!" I was perfectly contented to sit with my feet reclining peacefully on the rail and with my chair set at a convenient angle so that I might spit over the side without undue effort or shift in position.

Bill apparently held other views. He never is tired or sleepy. To my certain knowledge he had not slept more than two or three hours any night during the convention and yet here he was as bright and blooming as the proverbial daisy. Why the daisy originally was selected as the emblem of freshness never has been explained satisfactorily, so far as I am aware, but it has been used so extensively and for so long a time that I suppose it is useless at this late date to seek for a reason. For my part I employed the saying through force of habit, but if any reader feels inclined to submit a more suitable synonym I shall be pleased to give the subject serious consideration. Nothing could be fairer than that.

"Quite a change" said Bill, "In this vicinity since Cadillac and his little band of heroes wearily and thankfully drove their long canoes ashore and prepared to set up a home in the wilderness at the toilsome journey's end. I wonder what they would think or say if they returned today and saw what has happened since their departure."

"Well," I said, "I am no mind reader. I do not even attempt to hazard a guess at what the living are thinking and most assuredly I have no intention of worrying over the problematical thoughts of men whose bones long since have crumbled into silent dust and mingled with an alien land. Personally, I am quite thankful to think that our present journey is almost over and we will be home in the morning."

"There is something in that argument" Bill admitted. "Home is home and certainly no place can compare with it. However, there is no need of sniveling over it. You are on the way and when you wake in the morning you probably will be inside the breakwater safe and snug from every wind that blows. A few minutes afterward you can step ashore in comfort and find a line of cabs half a mile long, any one of them ready, nay anxious, to buck the traffic line and bear you away to your final destination dead or alive.

"Quite a contrast, if you ask me, to the conditions which prevailed when our old pioneering ancestors prowled over the great inland waterways in little birch bark canoes and with nothing but an old muzzle loading musket between them and starvation. Black murder and sudden death stalked by their side day and night in a hostile Indian country. Every tree in the forest was a potential hiding place for an enemy. Vicious tomahawks singing through the air almost were as common as the swarm of flies that stuck to them with teeth and claws and sucked their blood at every portage. Arrows a yard and a half long were whanged at them—"

"Ease off on the main sheet Bill" I said. "You'll have her on the rocks in

PADDLE YOUR OWN CANOE

a minute. I am willing a grant you the tomahawks and even the arrows, although my own private opinion is that you have stretched them about 2 feet beyond the standard length, but even a life long friendship will not stand the test of flies with teeth and claws. I may be half asleep but my credulity can be pushed just so far. Teeth and claws, my eye. Come down off your perch. What do you think you are telling me, a bedtime story?"

"Did you ever go on a fishing trip?" Bill remarked I thought a little irrelevantly. "No, I though not. Say, lemme tell ye something young feller. You try carrying a canoe for a mile over one of these old portages, stumbling over brush and bowlders, with the sweat dripping from the ends of your fingers and dribbling down among your poor tired toes and with a swarm of big hungry mosquitoes enthusiastically exploring every inch of your person. Before you travel half the distance you will be fully convinced that these pests not only have a full complement of teeth and claws, but that in addition they are red hot and poisoned. By the time you arrive at your destination your skin will be covered with lumps and you will begin to wonder if you are a warty pickle instead of a human being made after the image of your creator.

"Even after making allowance for your low grade of general intelligence —about *D* minus I should say offhand—I am surprised you should display such dense ignorance of boy scout knowledge. The next thing you will tell me is that you don't know how to tie any knot but a *granny* and I'll bet a dollar and a half, cash, that you think hunters and trappers get their furs from fir trees."

"Don't make me laugh," I said, "You borrowed the last dollar I had to pay the taxi fare down to the boat and yet here you are offering to wager vast sums of money as if you were starting out to see the world instead of creeping home broke. If I thought you had a cent, nothing would give me greater pleasure than taking it away from you. Even if I did not need the money, a purely hypothetical supposition, I should consider myself in duty bound to clean you out just to teach you a great moral lesson. You cannot settle an argument by betting."

"Maybe not" Bill remarked dryly. "Maybe not, my dear old college chum. Just the same I have noticed occasionally that the loss of a tidy sum is a powerful factor in assisting a man to change his mind.

"I have known several men, some with a little and others with no experience, who were fully convinced they could make a success of the foundry business. Figuratively they bet all they owned and sometimes all they could borrow, on the gamble. They kept up a brave front for a considerable period depending on the extent of their resources. When the last cent was gone and the place was sold to a junk man they finally admitted that they might just as well have spent their time pouring water down a rat hole in an attempt to corner the market in Russian sable.

" Far away cows have notoriously long horns and foundrymen are no different to other men in their belief in this peculiar form of hallucination. At one time or another nearly every general jobbing foundryman has toyed with the idea of adding a standard side line to fill in the slack periods. In some instances the plan works out satisfactorily, but

in others it is not so good. The special equipment entails considerable expense. Idle periods impair its efficiency. Maximum efficiency is impossible under intermittent operating conditions. Carrying a large stock has a crippling effect on a limited working capital.

"These various features and others were brought to mind the other day when I had an inquiry from a man who said he was contemplating entering the general jobbing foundry business. He proposed the manufacture of soil pipe and fittings and he wanted to know where he could find out the latest and best method for making these castings.

"The letter was almost telegraphic in its brevity, a feature which left me at rather a loose end. I pointed out that if he intended to pay a personal visit to the plants where soil pipe castings are made, then without doubt the best place is the Birmingham, Ala., district where soil pipe and other kinds of pipe are made in vast quantities. However, if he had no former experience along this line I suggested he secure the services of a competent man, at least to select and install the necessary equipment and instruct the help.

"I explained that the manufacture of soil pipe castings is a highly specialized branch of the casting industry and the entire output for the country is supplied by a comparatively small number of manufacturers. The initial expense of installing the necessary equipment is considerable and I doubted if the local demand would amount to enough to offset this first cost. Also I directed his attention to the fact that if he expected to develop a wider market he would find himself in competition with powerful interests that have dominated the national market for years. Naturally I admitted I was not familiar with his local conditions and therefore did not attempt to advise him in this respect.

"The smaller sizes of straight pipe, up to and including 5 inches diameter are molded two in a flask and poured through four runners connected to a long central gate from which the iron enters the two molds through many shallow gates. The set gate forms part of the pattern equipment and is detachable. It is only used on the plate while the drags are being rammed. The same pattern and plate serves for making both cope and drag.

"Formerly, four hand ladles were employed in pouring the molds, but present day practice favors a ladle shaped something like a small bathtub and provided with four spouts along one side, spaced to correspond with the four runners lined in a straight row in the center of the cope.

"The iron flasks are planed on the joints and are accurately machined on the open ends to embrace closely the machined ends of the cast iron core barrels. The flasks are designed to hold a minimum amount of sand and to that end the sides are slanted away from the joint instead of presenting the usual perpendicular appearance. Both cope and drag are barred and no bottom plates are needed. A sand strip on the inside at the joint helps to retain the sand when the flask is lifted from the pattern. The molds are rammed on an iron pattern plate mounted on four wheels. Two whole patterns which have been turned true in the lathe are mounted in such a manner that the upper surface of the pattern plate coincides with the longitudinal center line on the patterns. A toggle and lever combination serves to drop the patterns about ½ inch below the surface of the plate before the flask is lifted.

"Cores for the straight sections are formed by allowing green sand to fall from a predetermined height on a revolving barrel. A strike arranged in a suitable manner regulates the thickness of sand. Patterns for the special fittings, particularly in the larger sizes, are exact duplicates, plus contraction allowance, of the castings they are designed to reproduce. The pattern is split in two along a horizontal center line and both mold and core are made in green sand and at the same time. In the smaller sizes, split patterns are mounted on plates, usually attached to plain squeezers.

"The greatest care and accuracy are required in fitting up the flasks, patterns, arbors and coreboxes and then a suitable grade of sand, fairly close yet porous, must be employed in making the molds. The floor for the long sections is prepared in a special maner by laying two rails, or, in some instances, two concrete foundations about 5 feet apart, prefectly level and parallel on which to lay down the completed molds. Illustrated articles describing the manufacture of soil pipe and fittings at the Somerville Iron Works, Somerville, N. J.; Weiskittle & Son, Baltimore; National Foundry Co., Brooklyn, N. Y., were published in The Foundry Jan. 15, 1921; Dec. 15, 1922 and Feb. 1, 1925, respectively."

"Come on" I said and let's go to bed. "If we stay here any longer we'll be in the same boat as Geohegan. He rolled in late one night to meet a barage laid down by the faithful helpmate. 'It was 2 o'clock the following morning when you came home the other night and it was half past 2 the next morning when you came home last night. Now mind I'm telling you if it's 2 o'clock in the morning when you come home tonight or any other night the next morning, you'll have to get up and let yourself in.' The language as you may note by studying it closely is slightly eccentric and shows a decided tendency to travel in circles, but since poor Geohegan betrayed a similarity in taste and inclination, it is only fair to assume that the total result was as harmonious as the illustration indicates.

AFTER ALL THERE IS NO PLACE LIKE HOME

Roll Turning Methods Novel to Englishman

John Shaw, foundry manager Newhall works, Brightside Engineering & Foundry Co., Sheffield, England, delegated by the Institute of British Foundrymen to present the annual exchange paper at the Detroit convention of the American Foundrymen's association, was greatly impressed by the roll turning methods in a prominent foundry in the East. He saw five tools working simultaneously on a roll of 220 inches in length and declared the performance was marvelous.

Control Sand in the Foundry-I

Brief Outline of the Physical and Chemical Properties of Sand Is Presented—Simple Shop Tests Described for Determining the Five Main Characteristics

By L. B. Thomas

MOLDING sand is a mixture of quartz or silica, clay and feldspar, with a certain amount of oxide or iron, lime, magnesia and titanium.

Silica is the heat-resisting material; it contains but little if any bonding substance. Silica sand when fairly fine and tempered with water does possess a certain degree of cohesiveness, this property being largely due to surface tension. Silica alone is refractory; but by its union with magnesia, lime and iron, silicates are formed that fuse or melt at comparatively low temperatures.

Alumina and silica unite in all proportions to form clay. Where cohesiveness is required, alumina must be present. Alumina causes the particles of sand to hold together; hence, a sand high in alumina is refractory, but unlike silica, it is baked together like pottery at a high temperature; consequently, too much alumina must not be present in molding sand. When the bond (alumina) becomes excessive, it adheres to the castings and is carried out with the refuse sand, causing waste of new sand and increasing the cost of cleaning. The bond is a cement-like substance which by its cohesiveness ties the grain of sand more or less together without filling the interstices between the grains, thus the sand is said to be permeable to gases.

The sand, being permeable has a permeability number corresponding to the degree of permeability to gases of the sand. This number is determined by drawing or forcing a definite quantity of air through a standard prepared specimen of the sand to be tested in a specified length of time.

Soda and potash present in molding sands are combined with silica and alumina to form feldspar. Sands containing high percentages of feldspar are not highly refractory and should not be used where they are subjected to high casting temperatures.

Dry molding sand when placed upon the surface of molten metal should not crack or fuse; if it does, this is an indication that feldspar is present, and the sand if used to make molds should be watched carefully, for it may cause blow holes and slaggy castings. Sands often subjected under the microscope for examination reveal high percentages of feldspar.

Lime may exist in sand as oxide, hydrate, carbonate, or sulphate, but usually as carbonate or oxide. The carbonate is the most objectionable. Most of the lime salts are converted into oxides on burning; consequently, excess of lime will cause a mold to either drop or crumble. Magnesia is similar to lime, but less harmful, because it is more refractory. Organic matter gives bond to sand, but the bond is destroyed by the burning of the organic matter when it comes in contact with molten metal, causing the sand to shrink or crumble.

In all sands high in alumina, water has entered into chemical combination with other substances; this water is known as combined water. If sand containing combined water is heated to a fairly high temperature, the water is driven off, compelling the sand to shrink. This shrinkage may cause the surface of the mold to crack.

Compounds of iron if not in excess of 4 per cent seem to be beneficial rather than detrimental. It would seem that iron compounds bear relationship to so-called *fat* and *lean* clays. A good sticky clay is called a *fat* clay, while a clay which will not stick together when wet is a poor clay or *lean* clay. If these compounds of iron be converted into ferris oxide by high temperatures and in the presence of silica, they produce slag and the castings may prove defective, due to slag inclusions.

Therefore, the three predominating constituents of mold-sand are: Clay, feldspar, and quartz (silica). Pure clay, known technically as kaolin, is a hydrated silica of alumina having the formula: $[H_2 Al_2 (SiO_4)_2—H_2O]$. This is the basis of all clays designated by the following names:

Ball, pottery, pipe, stoneware, fire, flint, slip, brick, loam, marl, shale, etc. All these clays range through all stages of impurity down to the point where the material contains but little or none of the clay base and therefore technically cannot be classed as a clay. Table I gives the chemical composition of clay (kaolin) feldspar and quartz.

Feldspars are composed of silicate of alumina with variable amounts of potash, soda or lime, and are divided into two groups, the orthoclose and plagieclose feldspars. Feldspars are mostly clear and transparent, but sometimes they are white, flesh colored or green and frequently they are opaque because of impurities. They have a quartz-like luster, often slightly pearly. They are more or less fusible before the blowpipe.

Quartz (oxide of silica) occurs crystallized, usually in hexagonal prisms, with six-sided pyramid for termination; also granular or compact.

Control in Foundry

METHODS practiced in the shop for keeping the sand in workable condition are described in this paper first presented before the annual convention of the American Foundrymen's convention in Detroit Sept. 27-Oct. 1. The author L. B. Thomas is metallurgist with Fairbanks-Morse & Co., Three Rivers, Mich. So far as possible rare and difficult scientific and chemical terms have been omitted and the text is within the capacity of any ordinary intelligent foundryman even if he has not had the benefit of higher education.

Composition of molding sand is described in the first part of the paper with a brief reference to its physical and chemical properties. This is followed by reference to the five main characteristics of sand, bond, permeability, fineness, durability and refractoriness and their effect on the casting production when combined in varying proportions. Another factor which affects the durability or life of the sand is the prevailing temperature at which the metal is poured. Exceedingly hot iron destroys the bond in the sand more rapidly than iron poured at a lower temperature. A simplified method for grading sands by the fineness test is described. The paper closes with a description of shop tests to be made in conjunction with laboratory tests to determine the durability and refractoriness of molding sands.

Quartz is an essential constituent of a variety of rocks, granite, gneiss, sandstone, mica-schist and quartz porphyry.

Five Important Properties

There are five characteristics, bond (clay), permeability, fineness, durability and refractoriness in which we are interested because they are directly related to the workability of the sand and the quality of mold which it can produce.

When we speak of *bond* we refer to the clay content of the sand. We are interested in the per cent of bond (clay) because this is the substance that makes for cohesiveness. We fully realize the significance attached to the word cohesiveness, for it may apply to a fine sand that has but little bond, but on account of the surface tension there is considerable cohesion. When the molder has drops or fall-outs, it is due to the low percentage of clay substance, providing the temper is right and that the mold has been rammed properly. If the clay substance is too high, then we have other complications; the mold may blow, rough surface, etc. So we deem it important to determine the percentage of clay substance in each and every car of molding sand that enters the plant. However, this is not sufficient to insure good castings; the sand in the heap also must be tested at regular intervals to determine the percentage of clay substance.

By determining the percentage of clay substance in the new sand as received it is possible to control the heap sand by proper additions of new sand with a known clay content. Every foundry has different conditions. It has been our experience that where sand control work is adopted, it is absolutely necessary to study the existing conditions thoroughly before recommending any change in practice.

Table I

Chemical Compositions

	Kaolin per cent	Feldspar per cent	Quartz per cent
Silica	45.78	71.65	98.65
Alumina	36.46	16.10	1.09
Iron oxide	1.36	0.10	0.12
Lime	0.50	0.20	.....
Magnesia	0.14	.....	.....
Potassium	0.31	8.59	0.05
Sodium	.....	2.98	.....
Titanium	.....	0.03	.....
Loss on ignition	15.45	0.35	0.06
	100.00	100.00	100.00

Test Must Be Made

Often where one particular grade of sand has worked satisfactorily in one foundry, it does not seem to work as well in another. The quality of the sand used in each case may have been close. We know that there is a reason for it; but you often hear that this sand or that sand does not work satisfactorily. In a case of this kind, a thorough study of foundry conditions must be made and then it is possible to draw conclusions.

In many foundries considerable differences exist in the temperatures of the molten iron. In some cases the coke ratio is different and even the bed is higher or lower in practically the same size cupola; that is, the amount of coke above the tuyeres varies in height. Cupola operations determine the proper height of bed above the tuyeres, and a gage is made so that day in and day out this proper height can be maintained. It is necessary, to make sure that the bed is properly fired when the gage is used; otherwise the bed will be too low, the iron will be sluggish and will not run freely, due to oxidation. Although the cupola may melt quickly, the iron will be on the dull side; in some cases we have found the temperature as low as 2100 degrees Fahr. Iron on the dull side will not attack the clay substance nearly as readily as the higher temperature irons with a temperature of about 2350 degrees Fahr.; up in this range it does not take much of an increase in temperature to destroy the bonding qualities of some molding sands. In many foundries, where they are using big cast scrap in their cupola and melting on a high bed, the iron melts slowly but is exceedingly hot; therefore the loss in the bond of the molding sand is greater. This depends also on the size and shape of the castings.

Amount of Water

The best condition for sand tempering is where the sand is allowed to remain in a hopper or bin for at least 24 hours. This will cause the sand to mellow and will be sufficiently

Table II

Fineness Test of Molding Sands Containing Clay Bonds

Name of Sand	Per Cent Caught on No. 20	Per Cent Caught on No. 40	Per Cent Caught on No. 60	Per Cent Caught on No. 100	Per Cent Caught on No. 150	Per Cent Through No. 150
D—No. 5	0.00	14.80	23.20	29.20	4.20	27.80
D—No. 7	0.00	11.20	13.40	52.40	10.00	12.60
*D—No. 7	1.80	15.60	14.20	40.60	12.20	15.60
D—No. 7-A	0.00	1.80	6.80	59.00	11.60	20.80
G—No. 4	0.00	27.20	28.20	26.20	5.60	12.80
*G—No. 4	.20	37.74	29.38	20.60	4.08	7.96
G—No. 4-A	.20	31.40	23.00	22.60	5.80	17.00
*G—No. 4-A	.20	28.00	24.40	22.80	4.80	19.80
H—No. 2	.20	11.80	15.60	39.20	14.60	18.20
*H—No. 2	.20	20.00	22.20	40.60	8.00	9.00
H—No. 2-A	.40	8.20	14.20	40.40	13.40	23.40
*H—No. 2-A	.20	8.20	15.00	39.20	11.40	26.00
Hu—No. 2	0.00	2.40	9.40	33.60	30.20	34.40
*Hu—No. 2	.07	9.50	13.40	36.00	9.90	29.60
Hu—No. 2-A	0.00	1.60	6.60	37.00	22.80	32.00
*Hu—No. 2-A	1.20	4.00	8.60	27.60	21.20	37.40
Hu—No. 4	.40	36.60	21.40	23.60	6.20	11.80
*Hu—No. 4	0.00	24.60	20.60	27.40	6.20	21.20
WP—No. 1	.40	12.00	15.20	33.40	14.00	25.00
WP—No. 1-A	.20	11.40	19.60	24.60	12.00	16.20
*WP—No. 1-A	.70	2.90	10.50	49.60	10.80	24.00
WP—No. 2	.20	3.20	9.40	36.40	18.60	32.20

*Burnt.

Table III

Fineness Test of Molding Sands with Clay Content Removed

Name of Sand	Per Cent Caught on No. 20	Per Cent Caught on No. 40	Per Cent Caught on No. 60	Per Cent Caught on No. 100	Per Cent Caught on No. 150	Per Cent Through No. 150
D—No. 5	0.00	17.65	26.75	26.75	5.51	23.45
D—No. 7	0.00	13.27	12.56	48.50	11.87	14.00
*D—No. 7	.85	16.17	14.45	41.10	12.98	14.46
D—No. 7-A	0.00	13.00	13.50	50.00	10.50	13.00
G—No. 4	0.00	19.90	26.85	31.65	6.54	15.10
*G—No. 4	2.00	37.10	25.80	20.50	5.12	9.12
G—No. 4-A	.34	32.64	23.80	25.26	5.70	12.36
*G—No. 4-A	.05	32.00	24.55	23.70	5.45	14.15
H—No. 2	.78	8.41	13.41	38.90	15.10	23.45
*H—No. 2	1.75	13.75	17.75	36.50	11.25	19.00
H—No. 2-A	.37	8.52	14.62	38.02	13.57	25.00
Hu—No. 2	.55	1.93	6.34	32.23	21.21	37.74
*Hu—No. 2	.89	14.80	17.00	30.70	11.62	25.00
Hu—No. 2-A	0.00	1.30	6.00	32.00	19.30	41.40
*Hu—No. 2-A	3.02	6.75	9.53	30.95	16.50	33.25
Hu—No. 4	0.00	34.51	21.70	23.51	6.62	13.41
*Hu—No. 4	.22	37.45	21.15	23.45	5.45	12.30
WP—No. 1	.23	15.35	17.68	32.10	12.55	22.08
WP—No. 1-A	.23	15.60	17.70	32.80	13.27	21.40
WP—No. 2	2.50	3.75	10.68	34.75	15.30	35.25

*Burnt.

cool to insure the best casting and molding condition.

Some sands take more water than others when tempering; this condition is caused by the bonding substance. Just sufficient water must be added to bring back the life of the clay.

By this statement we do not mean that a sand that has been burnt, the silica that was formed by the heat, can be brought back to its original state of plasticity, the hydrated aluminum silicate, but we do mean that the large bulk of the original silicate must have sufficient water added to insure its maximum degree of cohesiveness. This moisture in sand can be determined easily once the temper is correct for that particular grade of molding sand.

In a molding sand containing approximately 25 per cent clay substance we have found that a moisture content of between 7 to 7.5 per cent works satisfactorily. We have used a rather crude method for the determination of moisture in molding sands, but it is believed to be accurate enough for foundry control work.

Methods of Test

A sample of sand is taken every hour and sent to the foundry sand control room, usually a small room in the foundry that has been turned over to the man in charge of sand testing. To do this work in the chemical laboratory causes more or less friction with the analyst. He will insist that you are getting sand all over the place. Careful as you may be, he will tell you that sand is getting into some of his beakers or flasks and spoiling his determinations. We have found that the best place for making sand control determinations is in a separate room, especially fitted.

It has been our practice to take 25 grams of the thoroughly mixed sample of sand to be tested for moisture, received in a glass stoppered bottle, and put it in an evaporating dish for about 10 minutes on a gas hot plate, weighing to constant weight. This has been sufficiently accurate to enable us to keep check on the moisture.

The method used in determining the clay substance in molding sand is described in detail in Appendix *A* in the second part of this paper.

A good molding sand that can be used for general molding must contain at least 20 per cent clay and in most cases can run as high as 30 per cent for maximum clay content.

The one big factor to bear in mind is uniformity of clay content in subsequent shipments. One carload must not be on the low side and the next carload on the high side. It is possible to maintain a uniform product that will not vary more than 1 or 2 per cent in clay substance.

Our tests all have been conducted with a special vent meter, which a sand producing company has placed on the market. This apparatus, together with detailed methods of operation, is described in the section under Appendix *B* in the second part of this paper.

Fineness of sand is determined by sifting 50 grams of dried sand through a nest of sieves; Nos. 20, 40, 60, 80, 100, 150 and 200 mesh. The sample is placed on a No. 20-mesh sieve and lightly rubbed with a No. 7 rubber stopper, holding the large end of the rubber stopper in the hand. After sifting on the 20-mesh for two or three minutes, the sand retained on the 20-mesh sieve is carefully weighed and reported as such. The 20-mesh sieve is put to one side, and the process repeated on all the other sieves. This is reported as fineness of sand containing clay substance (see Tables II and III). A fineness determination also is made on the sand after the clay substance is removed.

Wherever possible, sieves of the following sizes should be adopted, Nos. 6, 12, 20, 40, 70, 100, 140, 200 and 270. This standard set of sieves has been recommended by the American Foundrymen's association. In many foundries where sand control work is carried on, the only sieves available for fineness tests are ones that have been discarded by the chemical laboratory. These are not satisfactory always due in many cases to a large jump in sizes between certain sieves. It is recommended that a mechanical sieve shaker, the use of which may yield identical results, be used when making fineness determinations.

Before long every sand will be designated not only by a grade number for fineness but also by a class distinction for chemical and physical characteristics. Some sands have been tested by dealers for the degree of fineness. The degree of fineness of their respective sands determined, they have divided them into seven grades, according to their fineness as shown in Table IV.

Table IV

Fineness of Foundry Sands

Grade	Fineness factor
No. 0 Superfine	Above 100
No. 1 Fine	95 to 100
No. 2 Medium fine	85 to 95
No. 3 Medium	75 to 85
No. 4 Medium coarse	60 to 75
No. 5 Coarse	45 to 60
No. 6 Extra coarse	25 to 45

Example of Calculation of Fineness Factor *

Weight of sand Passing through sieves, in ounces		Number of mesh of sieves used		
55.22	×	100	=	5,522.00
20.89	×	80	=	1,671.00
11.64	×	60	=	698.40
10.57	×	40	=	422.80
1.20	×	20	=	24.00
0.06	×	1	=	0.06
0.42	×	60	=	25.20
100.00				8,363.66

$$\frac{8363.66}{100} = 83.64 \text{ Fineness factor.}$$

Sand with an 83.64 fineness factor would be classed as a No. 3 medium, nearly a No. 2 medium fine. Any loss is credited to the 60-mesh sieve. Any sand that does not go through the 20-mesh sieve is credited to the 1-mesh sieve.

*International Correspondence Schools, *Green Sand Molding*, Part 3, 1699-C.

As a general rule the smaller the grain, the finer the surface of the casting. In casting heavy masses of iron, a mold of fine sand will not take off the gases fast enough once they can no longer escape through the risers; therefore, the necessity of making tests to determine a sand that will produce a good smooth surface consistent with proper venting qualities. If the matter is complicated by angularity on the part of the grains, it is easy to see that too hard ramming can quickly spoil a mold made of sharp molding sand.

Belgian foundrymen are noted for their magnificent work the world over. The sand used is highly expensive and is looked after carefully. Foundrymen of France, Germany and England pay special attention to the preparation of sand with good results.

Consider High Resistance Alloys

Electrochemical Society Conducts Symposium on Metals For Extreme Conditions — Advance Requirements for Electric Furnace Linings

By L. M. Lamm

Washington Correspondent, THE FOUNDRY

THE fiftieth meeting of the American Electrochemical society was held at Washington, on Oct. 7, 8 and 9. H. W. Gillett, of the bureau of standards acted as chairman of a meeting at which a symposium on Materials for Extreme Conditions in the Electrochemical Industries was presented. Nine technical papers were presented at this symposium and only a limited time was given to the discussion of each, the time allotted for the meeting only being two hours. H. J. French, senior metallurgist of the bureau of standards in his paper on "Metals to Resist Corrosion or High Temperatures," discussed some of the principal characteristics and typical applications of metals used industrially to resist high temperatures or corrosion. Those considered included commercially pure copper, aluminum, lead, tin, silver, nickel, and iron and alloys in which these are the predominating elements. Mr. French said that his report is primarily a resume of previously published but widely scattered information, and he placed somewhat more emphasis on industrial applications than on laboratory test data.

"Laboratory tests," said Mr. French, "particularly those relating to corrosion, are only the first steps in the selection of metals for particular service, and for this reason industrial uses were stressed somewhat more than experimental data."

Among those taking part in the discussion of this paper were H. C. Parmalee, New York, who spoke briefly on the fabrication of tanks for chemical work and N. P. Pilling, International Nickel Co. who spoke of the rust troubles of the U. S. Coast and Geodetic Survey especially the wire rust.

W. M. Corse, National Research Council, Washington, was another of those entering into this discussion and he told of the experiments on a rust resisting metal which he had seen on an English automobile, the fittings of the machine having been exposed for almost a year with no corrosion or rust resulting. Mr. Corse said that this material had resisted acetic and citric acid. However, it is harder to fabricate than nickel silver and he said that he believed that it cost from 6 to 12 per cent more than ordinary iron.

Stanley M. Norwood, Union Carbide and Carbon Laboratories, Inc., was next called upon by Dr. Gillett to present his paper on "The Welding of High-Chromium Alloys Intended to Meet Extreme Conditions."

"One of the most important problems in the chemical industry," he said "is the design of equipment capable of withstanding the extreme conditions frequently encountered. In recent years marked advances have been made in the development of alloys resistant to pressure, temperature, and corrosion, because it has been found that improved efficiencies in many processes can be attained only through higher pressures and temperatures, the latter often exceeding red heat. Among such alloys, those containing 10 per cent or more of chromium have become particularly prominent. Of the numerous mechanical problems to be solved in the practical application of these alloys, welding must be considered as among the most pressing."

Dr. Gillett read a discussion prepared by John A. Matthews who was unable to be present.

"What the author of the paper states about the addition of nickel lowering the resistance of sulphur compounds," said Mr. Matthews, "is not in accordance with our experience. In fact, the plain ferro-nickels of, 30.00 per cent nickel are quite resistant to sulphuric acid and moderately resistant to hydrochloric acid, in which respect they differ remarkably from the straight chromium alloys. We have not yet an entirely satisfactory ferrous alloy to resist hydrochloric acid, but we have some which are more resistant than plain steel or chromium steels." At this point Mr. Seede, General Electric Co., Schenectady, N. Y., made a short talk on electric welding.

O. B. Westmont, research chemist of the Carborundum Co., Niagara Falls, N. Y., next was called upon by Dr. Gillett to present his paper on "Thermal Insulation of Electric Furnaces."

Mr. Westmont briefly discussed the thermal insulation of various types of electric furnaces. The thermal conductivities of fused alumina, fused magnesia, fireclay and a higher temperature insulating refractory were given by him in addition to the published data on silicon carbide and silica presented in his paper. He gave also the mean specific heat curves for these refractories. "The purpose of this paper," he said, "is to suggest possibilities of energy conservation in electric furnaces by properly designed composite cells. The discussion is purposely made general, for specific design features of individual types of electric furnaces would require a detailed study of each case."

"Generally speaking," said Mr. Westmont, "the linings of electric furnaces should be made from materials of greater refractoriness than are required in fuel heated furnaces for the same metallurgical processes. This results either from the higher temperatures actually used in carrying on the process in the furnace, or the extremely high temperatures encountered locally because the electrically produced heat is generated at a higher temperature than is required in the process involved."

Because Max Unger, electrical engineer of the General Electric Co. was unable to be present Mr. Seede of that company took charge of his paper on "Refractories For Induction Furnaces," at the request of Dr. Gillett.

"The requisites for a furnace lining," according to the paper, "of induction furnaces are detailed and discussed." Of the various materials studied, Mr. Seede pointed out, magnesium oxide proved to be a refractory more nearly fulfilling the conditions. Proper grading of the magnesium oxide is important, he pointed out. Pitch was selected as the best bonding material. Mr. Seede stated that for continuous operation on steel and slag analyzing 20 to 25 per cent silica, the magnesium oxide lining will last through 400 heats. He said that this was a conservative estimate as he knew that it had lasted as long as through 650 heats.

(Concluded on Page 878)

Grinders Speed Patternmaking

Exact and Duplicate Work Made Possible Through Use of Machines and Fixtures—Gives Directions For Repairing Disks

By Walter C. Ewalt

ONLY a few years ago, machine tools, with the exception perhaps of the lathe, first came into use in the pattern shop. Today many of these tools have become indispensable in large shops and much good has resulted in their use.

The machines, together with tools and fixtures, have reduced labor costs, which really is the first thing considered, and a greater profit therefore may be made. Generally speaking, the work done with the machine tools not only reduces costs but when using many of the machines, the quantity, quality and the accuracy obtained are reflected in greater prosperity.

As in the case of hand tools, the best always is the cheapest in the long run. When buying machine tools one should look for sturdiness in the frames and spindles. He should examine the bearings to make sure that they will give the longest life with the hardest work the machine is capable of doing.

The patternmaker's disk grinder shown in Figs. 1, 2 and 3, is one of the latest tools to be introduced, although, for many years, the patternmaker has had a similar tool which he made by glueing a piece of sand paper on a wood disk fastened to a face plate on the lathe. The superiority of the disk grinder of the present day over the old grinder readily may be seen. It is an integral machine devoted to grinding and not only may fine, finished and smooth surfaces be obtained but heavy cuts also may be made rapidly and accurately and with little or no trouble.

FIG. 1—THE PATTERNMAKER GENERATES ANGLES READILY BY LOCATING THE TABLE AT A PREDETERMINED ANGLE

Disk grinders are adapted particularly for grinding flat surfaces as well as making fine finishes and exact angles. They also are employed in securing accurate dimensions for beveling, jointing or mitering, rounding corners, rounding cylinders, coreprints (straight or tapered), sanding, planing and general fitting. In fact, like many other machine tools, new uses to which the disk grinder may be put, seem to be limited only by the ability of the operator. The man with greater initiative and ingenuity finds more methods by which to accomplish the work. Such tools have eliminated much hand work and now an apprentice may do much of the work which heretofore took a high degree of skill on the part of the journey-man.

The disk grinder either may be belt driven or have an individual drive. It may have a single disk or a disk at each end of the spindle, making it possible for two operators to work on opposite ends at the same time. Typical specifications of a disk grinder call for: 30-inch diameter wheel ¾-inch thick; spindle 2¼ inches in diameter; ball bearings spindle pulley 10-inch diameter and 5-inch face; spindle speed 900 revolutions per minute; work table 36 inches long and 15 inches wide—height from floor 36 inches. The machine also is equipped with a universal angle gage, universal duplicating gage, circle generating gage, dust hood and a countershaft. Disk wheels on some makes are of wrought steel and are machined with great care to give a perfect balance.

Grinding is accomplished with garnet paper or cloth sheets cemented to the wheels. The manufacturer usually furnishes a cement but a fairly thick shellac has also been found to be satisfactory. The paper or cloth sheets, called circles, wear according to the kind of work being done so that two a day may be required or one may last a month. For example, the continuous grinding of the end grain of cherry will cause the paper to wear exceptionally fast, while the grinding of pine with the grain causes much less wear. Resinous woods clog up the interstices of the circles, build-

FIG. 2—A SPECIAL RADIUS GENERATING FIXTURE IS USED TO FORM THE SURFACES OF GEAR-TOOTH PATTERNS

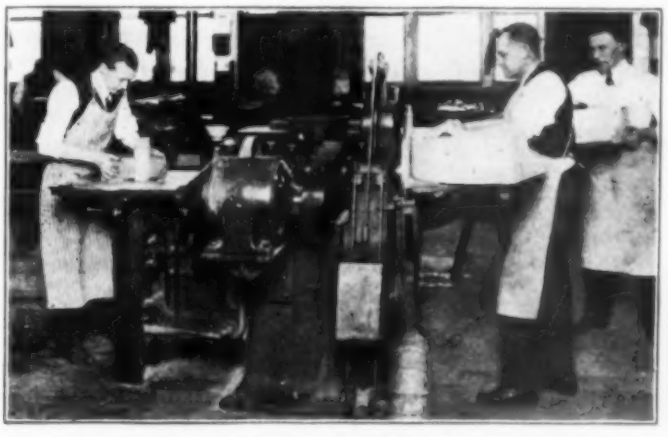


FIG. 3—TYPICAL COMBINATION SPINDLE AND DISK SANDER ADAPTED FOR A DIVERSITY OF LABOR SAVING OPERATIONS

ing up above the grains of garnet and making the circles useless. One of the best methods of cleaning out the dust which adheres to the circles and which was suggested by a friend of the writer, is to direct about an 80-pound pressure of air through a hose against the circles when revolving.

A method of cementing the circle on the disk with shellac is to apply one coat of fairly heavy shellac to the face of the disk and the back of the circle. After waiting about five minutes and when the shellac becomes sticky, place the circle on the disk and roll the circle with a rolling pin moving from the center of the circle toward the edge. This should be done all around the circle. The rolling pin evens the shellac underneath the circle and moves the surplus shellac to the outer edge and at the same time all of the air beneath the circle is expelled. Then a glued up board, about 2 inches thick and the diameter of the circle with face slightly rounded or convex so as to bear first against the center of the circle, is clamped to the wheel and left to set for an hour or two. When the clamps and board are taken off, the perimeter of the circle is trimmed even with the wheel with an old file sharpened on the edge. It may happen that a part of the circle near the center will not stick or will become loose. This is caused chiefly by the air between the disk and the circle not being expelled. In this case, punch a few holes through the circle at that place and apply a hot plate or the

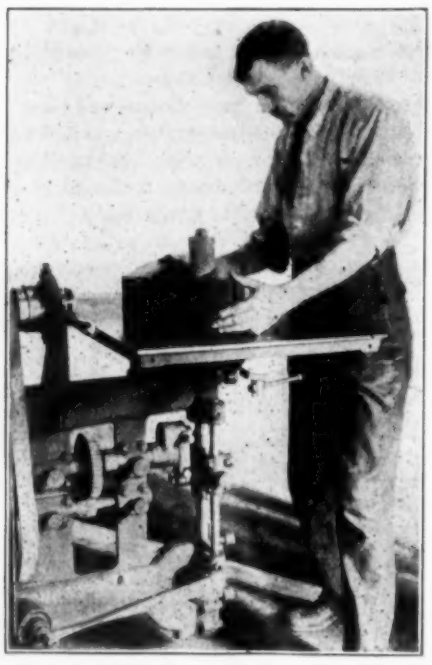


FIG. 4—METHOD OF USING A SPINDLE SANDER TO FINISH AN INNER SURFACE

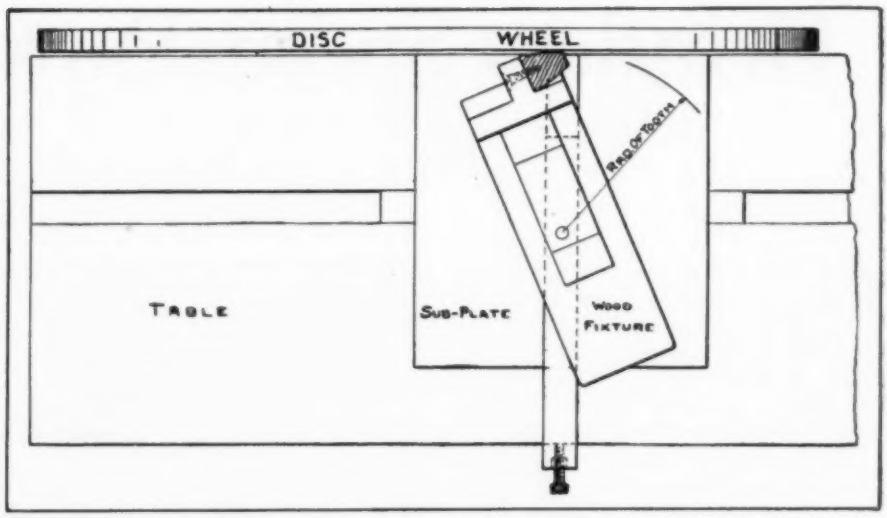


FIG. 5—DETAILS OF A SIMPLE WORK HOLDING FIXTURE FOR GENERATING TOOTH CURVES ON GEAR PATTERNS

electric stove, mentioned in a previous article in melting beeswax. By rubbing toward the punched holes the air is driven out and at the same time the shellac is melted on both the disk and circle so that when again rolled, the two surfaces will stick together.

Care Required in Storing

Reasonable care should be taken in storing the disks. They should be kept in a dry place and laid down flat. As a rule, most of the circle, when worn, may be pulled off the wheel easily. If some of the back of the circle remains on the wheel, start the wheel running. If a sharpened tool, like a flat chisel, is held against the the wheel, the remaining circle will be scraped off.

The work table is universal, that is, it may be tilted and locked at any angle. A locking pin automatically locates and locks the table at an angle of 90 degrees with the face of the disk. The table at any angle remains close to the face of the wheel, due to the design of the tilting axis. The table also may be raised or lowered from the center of the wheel, a desirable condition when either small or large work is ground. The table is counter-weighted by a steel cable which makes it easy to raise or lower, and it may be locked at any height desired.

A groove running parallel with the face of the wheel may be noted in Figs. 1 and 2 near the center of the surface of the table. Three sliding attachments are used in this groove. One of these attachments, shown in Fig. 1 and known as the sliding bevel gage or universal angle gage is mounted on a bar or tongue which slides in the groove of the table. The gage has a protractor graduated from 0 to 45 degrees each side from the center and may be used for right or left hand work. By adjusting the work table and the angle gage, any combination of angles may be obtained easily.

By this means the hopper bevels, mentioned in a previous article in THE FOUNDRY on joints and which require the time and the knowledge of an experienced workman to lay out, may be made simply.

It may be noticed that the fence of the gage has a dovetail at the back which allows the fence to be adjusted when at any tipped angle close to the grinding wheel and there locked by a turn of the hand nut. The work is better supported when it is held close to the grinding wheel.

(*Concluded on Page* 878)

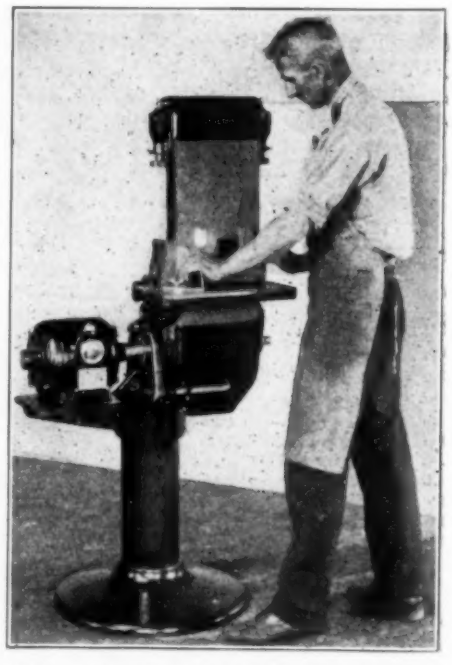


FIG. 6—ELECTRICALLY DRIVEN BELT SANDERS FINISHING FLAT SURFACES RAPIDLY

Old Iron Articles Dug Up

Buried Treasure

Eighteenth Century Foundry Products Dug Up by Workmen Recently in New York on the Site of Addition to Seamen's Church Institute Building. Cannon Shown in Foreground of Picture Wonderfully Preserved and Believed To Have Been Part of the Battery at the Landing at Coenties Slip in 1679

A NUMBER of interesting exhibits of the product of the iron industry about the middle of the eighteenth century were unearthed recently by workmen excavating for an addition to the Seamen's Church Institute building at South street and Coenties Slip, New York. In the days when New York was Nieu Amsterdam, a Dutchman by the name of Couraet Ten Eyck, familiarly known as Conraetje or Coentje, had his home and shop there and his name came to be given to the little pier which jutted out into the East river. The ground on which the building work is being done was filled in between 1791 and 1803. Thus the excavating has been done in ground which was a part of the bed of New York harbor up to the end of the eighteenth century, and which, as such, was the graveyard for all kinds of odds and ends that fell off or were cast off the ships. Several pigs of iron only slightly affected by oxidation are prominent among the objects dug up. One of these pigs distinctly bears the letters "N. York 1752," as well as the figure of an anchor. The lettering on the others cannot be clearly deciphered. Two interesting chunks of iron look like crops from forging bars. These are interesting chiefly because of the remarkable success with which they have withstood corrosion. An old axe, of the kind that was imported in large numbers from Holland in the seventeenth century to be traded to the Indians for beaver skins, appears to have been converted almost entirely into oxide.

Most conspicuous of the objects found is a small cast iron cannon, three feet long, with 2½-inch bore, which has been wonderfully preserved. It is believed to have been one of three guns which formed a battery at the landing at Coenties Slip in 1679. There is a double-ended "bar-shot" 16 inches long used by the British navy against the rigging of many war vessels, and liberally used against the American forces defending New York. This is a bar of wrought iron with a cast iron ball at each end. A number of solid shot about 6 inches in diameter and a number of grape shot also were found.

Reginald Pelham Bolton, of the New York Historical society, regards these as the "mute evidence of the bombardment of New York city on the afternoon of Saturday, July 12, 1776, by the British vessels PHOENIX and ROSE with their tenders."

The collection includes a big cast iron pot which was used for cooking. This is in good condition. There are some other castings and wrought iron articles, such as anchors and parts of anchors. The striking feature of the whole exhibit is the way in which this old cast iron and wrought iron has withstood the ravages of corrosion.

despite the fact that it has been buried in the earth over a century and a quarter, as well as having been immersed in the waters of New York harbor for an indefinite period.

The collection includes many other articles, such as a lead ink well of Revolutionary times, an old metal horse-bit of Spanish design, wooden blocks, copper tea kettles, saucers, pewter plates, spoons, crockery, etc. During the excavation two old ships were dug up on the site, one a 40-foot, oak vessel. Scattered about in the soil were many old rum bottles, some of which are of the squat pattern that was used for spirituous liquor in the earlier Colonial times.

Patternmaking Speeded By Grinders

(*Concluded from Page* 876)

An angle gage is used to hold a segment in position to grind a concave hexagon ring. The table and gage are clamped at the angles necessary to grind at one setting, each end surface at the required double angle. A sizing bevel and duplicating gage also has a protractor graduated from 0 to 45 degrees in either direction from the center. The gage proper rests on a subplate which has a tongue fastened to the underside. The tongue slides in the same groove of the table as the angle gage. This permits an end to end movement parallel to the face of the disk. The subplate also has a groove and a tongue which is fastened to the bottom of the duplicating gage. This permits a motion to and from the disk. A stop screw is attached to the end of the tongue by which an adjustment may be made regulating the amount to be ground. This gage is used chiefly to make the wood of an even thickness throughout or to make a number of pieces of equal length. However, a number of different operations may be made, such as grinding a segment of a cone. The table and gage are clamped in position for the two bevels and the stop screw regulates the amount of wood to be ground off whereby each piece is duplicated.

Circles Are Ground

The sizing circle or circle generating gage, is used to grind circles or true curves. This is a tongue which fits in the same subplate described under the duplicating gage. The tongue has a number of staggered holes drilled about one-half inch apart. A pin is provided which fits the holes and projects above the tongue about one-half inch. A hole the same size as the pin is bored in the wood to be ground, at the center of the radius. The radius being known, the measurement is taken from the center of the pin to the face of the disk and the stop screw provided at the end is adjusted to the edge of the table. Then the tongue is drawn back toward the operator; the hole in the wood is placed over the pin and shoved toward the wheel and ground. The stop screw then regulates the amount of stock to be ground and the pins permits a circular motion, thus producing circular or curved duplicate work if desired. Draft or tapered work, such as hubs, core-prints, bosses, etc., may be accomplished by tilting the table.

When grinding a half-circle the table is at right angles to the wheel and the work is ground square with the under side of the wood. By tilting the table either up or down, it is obvious a draft would be given the wood. Making a gear tooth is given as an example of where the three gages may be used on one job to a great advantage. When the teeth are sawed to approximately the required size, the ends may be squared by the angle gage. They also may be squared and duplicated in length by the duplicating gage. A wood fixture is then made as illustrated in Fig. 5, which sets on the pin of the circle generating gage. The position of the center of the pin to the face of the wheel equals the radius of the face of the tooth. The tooth is fastened to the fixture by a wood screw and the amount of wood ground off is regulated by the stop screw. The fixture is swung back and forth with the pin as a pivot and as the stop screw regulates the amount of wood ground off, every tooth is alike. The curve of one side of the tooth is ground first, then the tooth is reversed or the fixture may be made to screw on the opposite side of that where it is shown and the other face or side ground. The table is set at an angle to give a small draft from end to end of the tooth.

Fig. 4 shows the roll sander machine. Core-boxes and interval curves may be finished on this machine. The roll is made of metal and covered with a strip of garnet paper. It moves up and down, while revolving, causing a grinding motion of two directions. This has a tendency to clear the dust and prolongs the life of the paper. The table remains level while the roll is tilted from 0 to 45 degrees. The angle to which the roll is adjusted to position is taken by a graduated scale attached to the machine.

The sander is an exceptionally good machine for a wood pattern shop. In many shops it is run continuously, especially where a number of men are employed. It is rather difficult to say how many hours are saved by the use of a grinder as this will depend on the number of men employed, but whatever the size of the shop, the saving will be considerable. The surface of the wood, after being ground, makes a perfect glue joint and unless a coarse grit of garnet is used, a satisfactory surface is obtained for shellacing.

Consider Resistance Alloys

(*Concluded from Page* 874)

Dr. Gillett next called upon George E. Merritt of the bureau of standards to present his paper on "The Thermal Expansion of Some Fused Oxides Used as Refractories." Mr. Merritt illustrated his talk with some lantern slides.

Mr. Merritt said that the thermal expansions of the oxide of silicon, thorium and zirconium, of a mixture of one-to-one molecular proportions of thoria and zirconia, and of the refractories made of magnesium, alumina, and zirconia were measured. He exhibited the results in graphical form with his lantern slides. From the form of the curves and other evidence he concluded that the combination took place when thoria and zirconia were fused in the proportions he mentioned.

Heads Seattle Branch

Yale D. Hills has been made branch manager of the Seattle branch of the Timken Roller Bearing Co., Canton, O. R. H. Cross who formerly held this position has been made assistant to G. C. McMullen, district manager of sales, and will continue to maintain offices in Seattle.

Announce Closing Date for Papers

The last date for the receipt of papers intended to be presented at the annual general meeting of the Institute of Metals, to be held in London on March 9 and 10, 1927, is Nov. 15.

These are the first diesel electrics to be built in the United States and while the Pennsylvania is to use them in the nature of an experiment, the wider utilization of this type of power unit by American railroads is forecast by many.

Milestones in Foundry Progress

As Recorded in the November Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

1896

GROVER CLEVELAND

CONGRATULATIONS were extended to the Philadelphia Foundrymen's association at its November meeting, reported in THE FOUNDRY for November, 1896, for the excellent manner in which the first convention of the American Foundrymen's association had been handled. Detroit was decided upon as the location for the meeting to be held the following year.

* * *

Considerable interest was expressed in retrospect, regarding the paper of C. James on the subject of chemical analysis of iron for the cupola. Some member suggested employing a chemist at a small fee to work for all members of the association. The movement lost by default.

* * *

RECKLESS RHYMES

The chemist is a hardy man,
And a tough skinned bird is he.
He juggles tubes,
Equations and cubes,
For a paltry little fee.

A. V.

* * *

Tom Bowers announced his theory that by grading men according to their ability and paying them on the same comparative basis, greater efficiency might be obtained in the foundry operated under his ever curious boss, Pokey.

* * *

The election was over, and the politicians who had been engaged in saving the country by ranting against the other party were stepping quietly off stage, while business in general was improving.

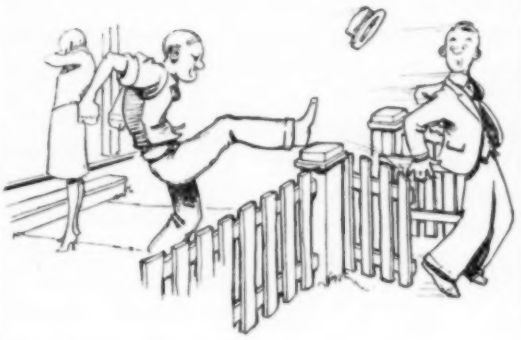
* * *

Only one good accrues from this hysteria of country saving that sweeps the land every four years. The election keeps the ranters quiet until the next campaign season.

* * *

J. P. Pero, later a president of the American Foundrymen's association appeared for the first time as a contributor to THE FOUNDRY with an article on science of foundry management.

Faked Foundry Facts



Pop Gates

The Master Car Builders' association announced that cast-iron car wheels were increasing in durability. A life of seven years was the average for 1885, and 15 years for 1895. Against this could be charged the increase of weight of cars, giving a much greater efficiency for the 1895 car wheels even under the heavier loadings of that day.

1906

THEODORE ROOSEVELT

FERRO MACHINE & FOUNDRY CO., Cleveland, furnished the inspiration for the leading article in THE FOUNDRY for November, 1906. This shop then was making small, two-cylinder automobile engine blocks, special work for marine engines and miscellaneous light jobbing castings. Iron was melted in a single 6-ton cupola and a 15-ton air furnace.

* * *

John T. Stoney, the prophet of the green-sand cylinder evidently had not yet conceived his big idea which has done so much for cylinder casting in later years.

* * *

The question of using direct metal, that is blast furnace metal, for castings was discussed, with the weight of opinion against its practical use in the foundry.

The foundry department of the Lunkenheimer Co., Cincinnati, was described in detail.

* * *

A large number of by-product coke plants had just started in a number of places. This proved a fortunate condition for foundrymen, since the standard beehive coke was practically off the market.

* * *

The program of the Birmingham branch of the British Foundrymen's association featured the names of Prof. Thomas Turner, Percy Longmuir, B. Hailstone and F. G. Cook. All of these names later became familiar to American foundrymen and Thomas Turner was the recipient of the Seaman medal at the Detroit convention.

1916

WOODROW WILSON

MOLDING the eight-cylinder 1917, Cadillac motor block was the theme of the leading story in the issue of November, 1916. The molds were oven dried and assembled for pouring.

* * *

The process of casting car wheels with high manganese treads was explained and profusely illustrated. This method was developed at the Granite City, Ill., plant of the American Steel Foundries.

* * *

A paper on sand reclamation by H. B. Swan, at present head of the foundry department of the Cadillac Motor Car Co., Detroit, was presented.

* * *

The Moline Malleable Iron Co. foundry at Moline, Ill., was offered as a model of up-to-date construction.

* * *

Pig iron was selling at $21.95 a ton, Pittsburgh, and $15.50 a ton, Birmingham for No. 2 foundry grades. The rise incident to the war, apparently had started.

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor

CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶ Don't Howl—No Upset Yet

NOW that we are entering the fourth quarter of the year, business men and others who may be interested can look back and check up operating conditions for the year and compare them with the cautious and pessimistic prognostications given out by self constituted prophets in the spring and early summer. Every year for the past two or three the calamity howler has been abroad in the land prophesying an era of depression and every year during the closing months these same self appointed molders of public opinion have had to pull in their horns and admit they were mistaken. Perhaps mistaken is hardly the word. A prophet never is mistaken. Sometimes untoward events interfere with the smooth operation of the schedule as laid out in the prophet's proclamation. Therefore he is free to disclaim all responsibility. His carefully laid program has no place for a stray dog that may upset the apple cart. He calmly announces, under pressure, that through a most extraordinary combination of unlooked for circumstances, the business world has managed to stagger through the year in middling fair shape, but—this *but* is like a snake's tail, it never dies—next year the country surely is going on its uppers.

WHERE no pressure is applied the prophet maintains a discreet silence on what has been published in the past, but usually he is as voluble as ever in predicting events for the future. He receives able and loyal support from the public whose memory is in inverse ratio to its individual and collective capacity for absorbing rumors. The past year has been no exception. For several years the bogey of cut throat European competition, based on low wages, has been held up as the direct cause of depressed business conditions that surely are on the way. Last year we were warned that an unhappy and consequently angry farmer element in the population was going to fill the bearings of the business machine with large quantities of exceedingly sharp sand. This year installment buying was pointed to with alarm as the horrid rock on which the national business ship was going to be wrecked.

Where is the panic, the deflation, the depression, the hard times and the soup kitchens? Not among the iron and steel men with their plants running 90 per cent capacity. Not among the farmers with the greatest crop on record. Not among the merchants, wholesale and retail whose volume of business never was better. Finally we come to the bankers, the only boys who really know whether the country's business is going up or down. This astute body recently conducted a survey to determine whether the epidemic of installment buying constituted a menace to the financial well being of the country. Certainly you never saw the report. It was suppressed.

¶ Presents a Challenge

JOHN CAMERON, past president of the Institute of British Foundrymen, in an address at the complimentary dinner tendered to the overseas party at Pittsburgh, Oct. 9, said: "The manufacture of cast iron is not yet a science. We are just beginning to find out how the properties of cast iron may be improved. Such progress as has been made is due to the tireless work and study of men who compose our technical associations." After spending the greater part of an exceedingly busy life in the foundry industry in many countries, his opinion is worthy of consideration.

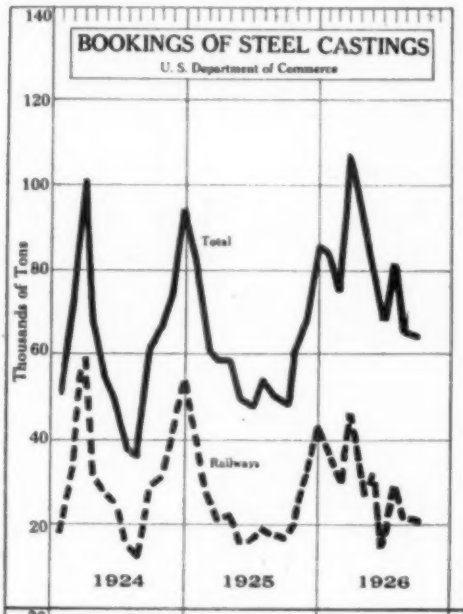
THIS brief but weighty point, in Mr. Cameron's address which in the main dwelt upon the progress that has been made in the foundry industry, advancements which prompted the speaker to affirm that he was "proud to be a craftsman," constitutes a challenge to the gray iron industry. Perhaps, its import is even greater in America than abroad, where a number of important advances have been made within the past few years. It should carry an inspiration to those younger metallurgists and foundrymen of America whose faith in the future service and widened field of usefulness of gray iron has remained unshaken under encroachments of other materials.

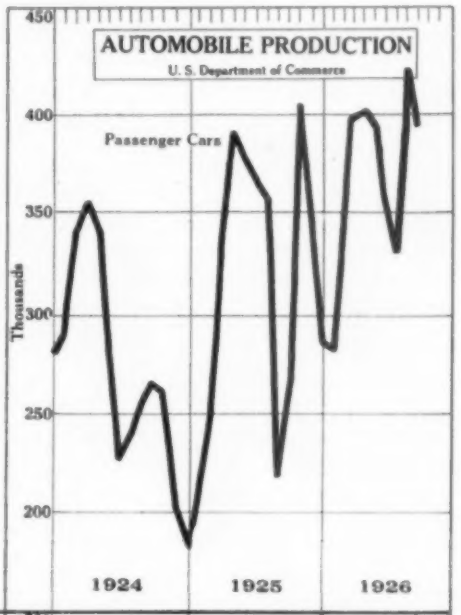
Trade Trends in Tabloid

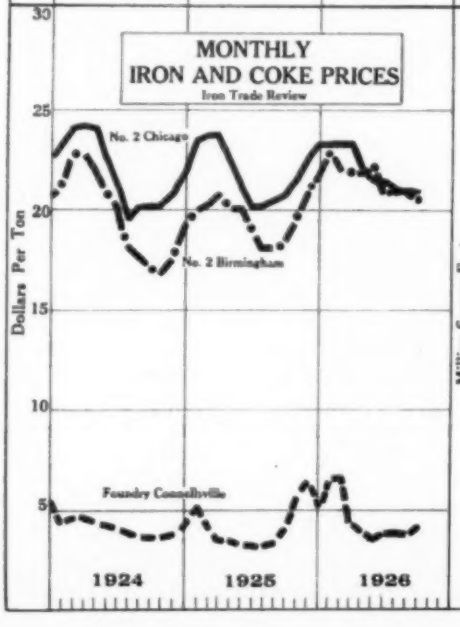
WITH the advance of winter, the demand for foundry products is holding steady, although the same tendency to buy only for immediate needs continues. In brass foundry lines, particularly in the East, complaint is made of price cutting, but the volume of business is steady and satisfactory. Steel foundry operations continue at about 50 per cent of capacity with railway specialties acting as a drag. Railway equipment purchases still are light, although the freight car loadings are the highest ever reported for this season of the year. A shortage of open top, or gondola, type cars is growing. Automobile sales are slower, in the aggregate, although the production of some of the leading manufacturers continues at a high rate. Building construction permits continue satisfactory, September showing an increase over August, but standing 2 per cent less than for September, 1925. Industrial and commercial structures lead residence construction in the fall reports. Demand for plumbing sundries and sanitary ware is slightly below the same season of last year. Fall financial reports of industrial concerns, particularly the larger implement interests, steel companies and electrical machinery builders, indicate highly satisfactory earnings. Sales of pattern lumber, an index of future business, are fair, but all purchases are made on a hand-to-mouth basis, for immediate shipment.

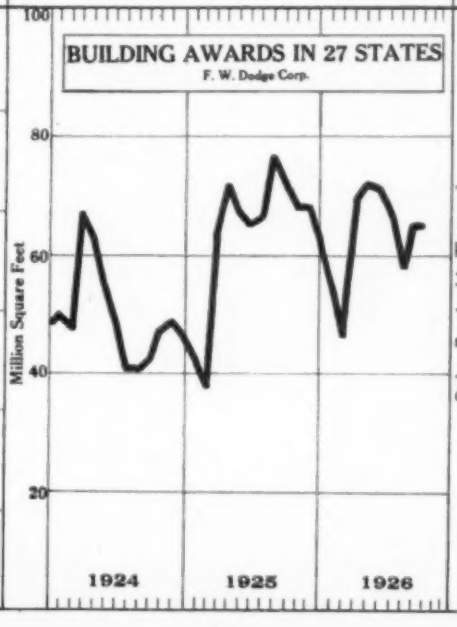
RAW MATERIAL PRICES
Oct. 22, 1926

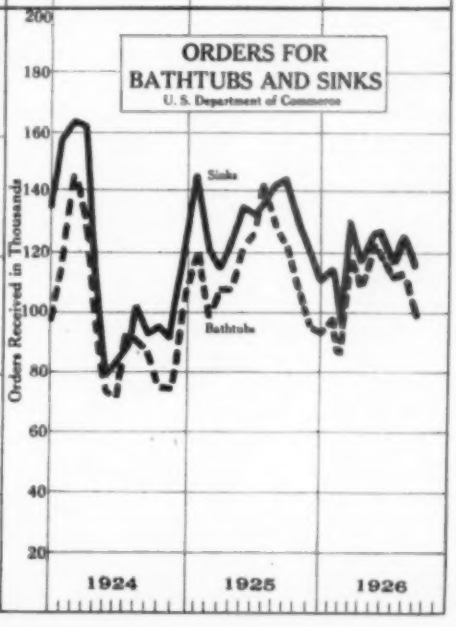
Iron	
No. 2 foundry, Valley	$18.50 to 19.00
No. 2 Southern Birmingham	20.00
No. 2 foundry, Chicago	21.00
No. 2 foundry, Philadelphia	21.76 to 22.39
No. 2 foundry, Buffalo	20.00
Basic, Valley	18.00 to 18.50
Basic, Buffalo	19.00
Malleable, Chicago	21.00
Malleable, Buffalo	20.00
Coke	
Connellsville foundry, coke	$4.75 to 5.00
Wise County foundry coke	4.50 to 5.00
Scrap	
Heavy melting steel, Valley	$16.00 to 16.50
Heavy melting steel, Pitts	17.50 to 18.00
Heavy melting steel, Chicago	13.00 to 13.50
Stove plate, Chicago	14.00 to 14.50
No. 1 cast, New York	13.25 to 14.00
No. 1 cast, Chicago	16.50 to 17.00
No. 1 cast, Philadelphia	17.50 to 18.00
No. 1 cast, Pittsburgh	16.00 to 16.50
No. 1 cast, Birmingham	16.50 to 17.00
No. 1 cast, Buffalo	16.50 to 17.00
Car wheels, iron, Pittsburgh	16.00 to 16.50
Car wheels, iron, Chicago	14.50 to 15.00
Railroad malleable, Chicago	16.50 to 17.00
Agricultural, mall., Chicago	15.25 to 15.75
Malleable, Buffalo	17.50 to 18.00
Railroad Malleable, Pitts	18.00 to 18.50
Nonferrous Metals	Cents per pound
Casting copper, refinery	13.80
Electro copper, refinery	14.07½ to 14.12½
Straits tin	68.75 to 69.00
Lead, New York	8.32½ to 8.35
Antimony, New York	14.25
Nickel, electro	39.00
Aluminum, No. 12, prod'rs	26.50
Aluminum, No. 12, remelt	22.50 to 23.00
Zinc, E. St. Louis, Ill	7.30











Comings and Goings of Foundrymen

J W. BROADHURST who recently became associated with the United States Radiator Corp., Detroit, as general superintendent of its plant at Geneva, N. Y., has spent considerable time in the metallurgical field. He was assistant chemist, chemist and blower at the Dover furnace of the M. A. Hanna Co., from 1906 to 1911. In 1911 he was in the drop forge plant of the Cleveland Hardware Co., Cleveland, and in 1912 became connected with the American Steel & Wire Co., Cleveland, as melting supervisor. Mr. Broadhurst then associated with the Ferro Machine & Foundry Co., Cleveland, in the metallurgical and melting division where he remained until 1915. From 1915 to 1926 he was in the metallurgical division and melting supervisor for the Wilson Foundry & Machine Co., Pontiac, Mich.

Harry W. Holt, Charles W. Eggenweiler and William T. Bohn are the three new vice presidents of the Bohn Aluminum & Brass Corp., Detroit.

O. N. Yule, purchasing agent of the Frost Mfg. Co., brass founder, Kenosha, Wis., was elected president of the Milwaukee Association of Purchasing Agents at the annual meeting on Oct. 12.

H. J. Rodgers has been appointed purchasing agent of the Lennox Furnace Co., Marshalltown, Iowa, and will have charge of the buying for the plants in that city and Syracuse, N. Y. He previously was connected with a different industry in Marshalltown.

John H. McCormick has been elected president and general manager of the Lycoming Mfg. Co., Williamsport, Pa., manufacturers of motors for automotive use. He formerly was vice president and secretary. W. H. Beal succeeds him as secretary.

J. W. Haynes now is in charge of the melting department of the Maytag Co., Newton, Iowa. Mr. Haynes was superintendent of the Wellston Mfg. Co., Wellston, O., for three years, superintendent of the Iron Products Co., Columbus, O., for four years, superintendent of the Mahoning Foundry Co., Youngstown, O., for three years and superintendent for the Hayes Pump & Planter Co., Galva, Ill., for two years.

E. H. Sholar, president of the Chattanooga Implement & Mfg. Co., was elected to succeed himself as president of the Chattanooga Manufacturers' association at a meeting of the board of governors recently. This is Mr. Sholar's third term, only one other man, the founder of the organization, having been similarly honored. W. O. McCord, superintendent of the Chattanooga plant of International Harvester Co., was made treasurer.

Creed W. Fulton, for the last 3½ years works manager of Goulds Pumps, Inc., Seneca Falls, N. Y., has recently resigned his position to go into the engineering and contracting business with headquarters in Washington. Mr. Fulton was with Goulds Pumps, Inc., formerly Goulds Mfg. Co., continuously from 1909 to 1926. During that period he was New England sales manager for nearly eight years, returning to Seneca Falls in 1923 to become works manager. In his new line of endeavor, Mr. Fulton becomes vice president and general manager of the Baker Cork and Tile Co., Inc., with offices in Washington and Baltimore, also vice president and general manager of Baker-Fulton, Inc., with offices at 1110 F Street, N. W., Washington. He is devoting his time to mechanical and industrial engineering in connection with certain industrial developments in the South.

Standard Crane Builders Form Association

Representatives of a large majority of the standard crane capacity of the country organized the Crane Manufacturers' association at Cleveland, Oct. 19. Officers are: President, H. W. Standart, Northern Engineering Works, Detroit; vice president, Frank Hatch, Shepard Electric Crane & Hoist Mfg. Co., Montour Falls, N. Y., and secretary-treasurer, S. Buckley, Niles Crane Corp., Philadelphia. Members of the association are: Alliance Machine Co., Alliance, O.; Box Crane & Hoist Corp., Philadelphia; Cleveland Crane & Engineering Co., Wickliffe, O.; Harnischfeger Corp., Milwaukee; Morgan Engineering Works, Alliance, O.; Manning, Maxwell & Moore, Inc., New York; Milwaukee Electric Crane Co., Milwaukee; Niles Crane Corp., Philadelphia; Northern Engineering Works, Detroit; Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.; and Whiting Corp., Harvey, Ill. Details of the organization will be perfected at a meeting to be held in about a month.

Honor New President

The regular meeting of the Detroit Foundrymen's association held Thursday, Oct. 21, at the Union League Club, Detroit, was dedicated to Stuart Wells Utley, newly elected president of the American Foundrymen's association. Various committees which had been in charge of arrangements for the thirtieth annual convention of the American Foundrymen's association and the Second International Foundrymen's Congress reported at this meeting.

Roller Bearings Described

Engineers, master mechanics and plant executives will be interested in the new catalog on roller bearings recently pulished by the Timken Roller Bearing Co., Canton, O. Construction features of the bearings are given as is the method for calculating the load on the bearings with various influencing or modifying factors. Tables containing the various types with the sizes and ratings of each are presented. Methods of mounting the bearings in machines are described as are cone and cup fitting practices. Lubrication and shop inspection to keep the bearings in good operating condition are explained in detail. The book is illustrated with diagrams, tables and formulas, making it a valuable addition to the plant library.

Extend Contest Time

The Pangborn Corp., Hagerstown, Md., has extended the time for the announcement of the result of its sandblast abrasive contest conducted at the Detroit convention. No correct answers were submitted and as the provisions of the contest stated that prizes would be based upon the receipt of correct answers, simplified conditions will be announced about Nov. 15 upon which a distribution of prizes will be made.

Wood Snap Mold Jackets Contract in Use

Question: We use dried white pine for our snap molds and find that they are too tight after the first or second application. We make them 1/16-inch smaller than the flask to insure a tight fit.

Answer: Apparently the wood is not thoroughly dried or it would not contract. We suggest you either dry the lumber or dry the jackets after they are made and before you place them on the molds. Once they have reached their limit and are thoroughly dried they will contract no further. To determine the actual contraction, make a jacket the full size of the snap flask, place the jacket in the core oven for several hours with a slow fire, then carefully measure the inside of the jackets and base the measurement of succeeding jackets on the information obtained. Dry all the jackets thoroughly by leaving them in the core oven over night. If no core oven is available, any one of several alternative methods may be adopted.

Builds Larger Office

The Ohio Brass Co., Mansfield, O., has started construction work on a new administration building, a five-story steel and brick structure 52 x 255 feet. Provision has been made for a 25 per cent increase over the present office force. General administrative offices and sales headquarters to handle the seven divisions which serve five different industries have been planned. A conference room seating 350 is provided.

Newark Society Holds October Meeting

The first fall meeting of the Newark Foundrymen's association was held at the Down Town Club Wednesday, Oct. 27, at 6 p. m. Dr. Richard Moldenke, Watchung, N. J., addressed the members and guests on the latest developments in foundry practice.

The Newark association has distributed to all of its members copies of the standard pattern colors adopted by the American Foundrymen's association and co-operating agencies. W. H. Mantz, Atlas Foundry Co., Irvington, N. Y., is secretary.

Officers Are Elected

Charles M. Schwab, Bethlehem Steel Corp., Bethlehem, Pa., was elected president of the American Society of Mechanical Engineers for the coming year at the annual election of officers recently held. Charles L. Newcomb, manager, Deane works of the Worthington Pump & Machine Corp., Holyoke, Mass.; Everett O. Eastwood, professor of mechanical engineering, University of Washington, Seattle, and Edwards R. Fish, vice president, Heine Boiler Co., St.Louis, were elected vice presidents. Erik Oberg, editor of *Machinery*, New York, was re-elected treasurer. Three new members of the council of the society who also were elected are: Paul Doty, chairman, Minnesota state board of registration St. Paul; Ralph E. Flanders, general manager, Jones & Lamson Machine Co., Springfield, Vt., and Conrad Lauer, treasurer and general manager, Day & Zimmermann, Philadelphia.

Appoint New Secretary

The Institute of British Foundrymen has designated Thomas Makemson, 21 Beresford road, Stratford, Manchester, England, as secretary, dating from Dec. 1, 1926. Mr. Beresford is a practical foundryman and has been secretary of the Lancashire branch for a number of years. He has been a member of the Institute of British Foundrymen since 1917.

Obituary

Harry H. Bassett, a vice president of General Motors Corp. and president of the Buick Motor Co., died October 17 in the American hospital at Neuilly, France. He had been ill for only a few days, suffering from bronchial pneumonia. Mr. Bassett was born in Utica, N. Y. in 1875. He first worked for the Remington Arms Co. in Ilion, N. Y., becoming assistant to the general manager. He then became assistant superintendent of the Weston-Mott Co., Utica, N. Y. In 1907 he was appointed manager of the Weston-Mott Co.'s new plant at Flint, Mich., and in 1913 was made assistant manager of the Buick Motor Co. with which the Weston-Mott Co. had consolidated.

Foundry Association Directory

The Buffalo Foundrymen
Buffalo

President, J. McARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, CHARLES L. LARSEN, Armour Insitute of Technology, 3200 Federal street Chicago; secretary, ROGERS A. FISKE, 105 LaSalle street, Chicago. Meetings second Saturday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, FRED W. STICKLE, Capitol Foundry Co., Hartford, Conn.; secretary, C. S. NEUMANN, Union Mfg. Co., New Britain, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association
Detroit

President, ROBERT G. CRAWFORD, Atlas Foundry Co., 131 South Artillery street, Detroit; secretary, RUSSELL M. SCOTT, Packard Motor Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

Metropolitan Brass Foundry Association
New York

President, THOMAS HARPER, Thomas Harper, 204 Lafayette street, New York; secretary WM. E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meetings second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry, Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meetings called by president.

New England Foundrymen's Association

President, H. P. BLUMENAUER, Arcade Malleable Iron Co., Worcester, Mass.; Secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio State Foundrymen's Association

President, WALTER L. SEELBACH, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary HOWARD EVANS, J. W. Paxson Co., Luzerne and D streets, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
Pittsburgh

President, LAWRENCE V. STEVENS, Locomotive Stoker Co., N. E. Pittsburgh; secretary-treasurer, WM. J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association
Davenport, Iowa

President J. H. DIEDRICH, Blackhawk Foundry & Machine Co., Davenport, Iowa; secretary-treasurer, A. D. ZIEBARTH, Davenport Foundry & Machine Co., Davenport, Iowa. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Southern Metal Trades Association
Atlanta, Ga.

President, GEORGE B. COCKER, Gastonia, N. C.; secretary-treasurer, W. E. DUNN JR., Healey building, Atlanta, Ga.

Tri-City Technical Council
Moline, Ill.

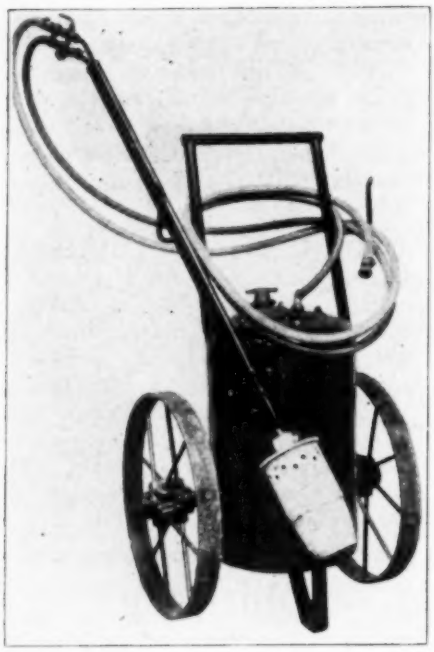
Chairman, H. BORNSTEIN, Deere & Co., Moline, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association
Cincinnati

President, HAROLD P. RITTER, John A. Oberhelman Foundry Co., 3323 Colerain avenue; secretary, GEORGE W. PIEHL, Wessling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association
Minneapolis-St. Paul

President, J. A. TEACH, Minneapolis Steel & Machinery Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, So., Minneapolis. Meetings monthly at the Athletic club.



THE BURNER OF THIS TORCH MAY BE CLEANED EASILY

Introduces Oil Torch

The Hauck Mfg. Co., 126-134 Tenth street, Brooklyn, N. Y., recently has placed a venturi suction torch on the market. The burner on this torch is made of sheet steel and pipe and the nozzle of cast iron. The burner may be dismantled for cleaning by removing the nozzle and the atomizer nose. The tank is made of seamless drawn pressed steel with bottoms interlapped and brazed. All fittings connections are welded. The tank is equipped with a double wire gauze screen in the filter connections to prevent ignition of oil or gases in the tank. A ball check in the filter cap seals the tank if the tank is tilted or upset.

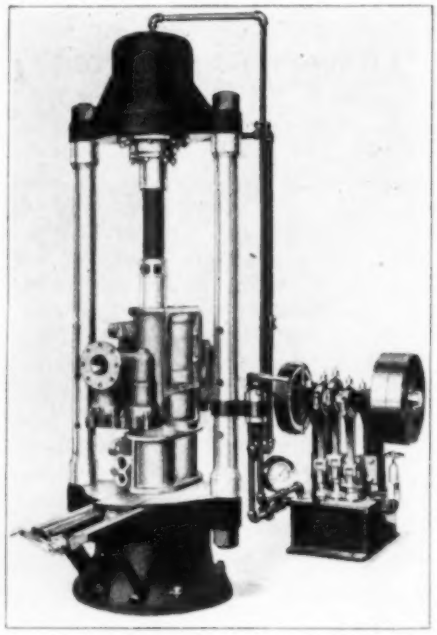
To light the burner, the oil valve is opened three or four turns. Burning waste or paper, or a wick torch is held underneath the nozzle and the air cock is opened gradually until the burner lights. The burner will ignite instantly when a good air oil mixture is obtained. Preheating or occasional warming is necessary. The torch may be operated 14 feet above the level of the tank. The torch will function on fuel oil as heavy as 28 degrees Baume and on all lighter oil and distillates. Only the usual air pressure of from 50 to 100 pounds per square inch is required.

American Crucible Products Co., formerly of Elyria, O., has removed its general offices and manufacturing plant to Lorain, O. Increase in demand for the products made by the firm caused the change.

Straighten Castings on Hydraulic Press

The National Brake & Electric Co., Milwaukee, has designed a hydraulic press for straightening distorted and warped steel, malleable castings, steel forgings, etc. The press is actuated by a vertical triplex hydraulic pump in which ordinary machine oil is used, thus permitting the press to be operated in cold weather without freezing. The pump is designed to deliver 4000 pounds pressure, which in turn develops 150 tons pressure on the ram of the press.

A number of interesting features are included on this press, such as a four-way operating valve, adjustable safety valve for the pump and



A PRESSURE OF 150 TONS MAY BE SECURED ON THIS PRESS

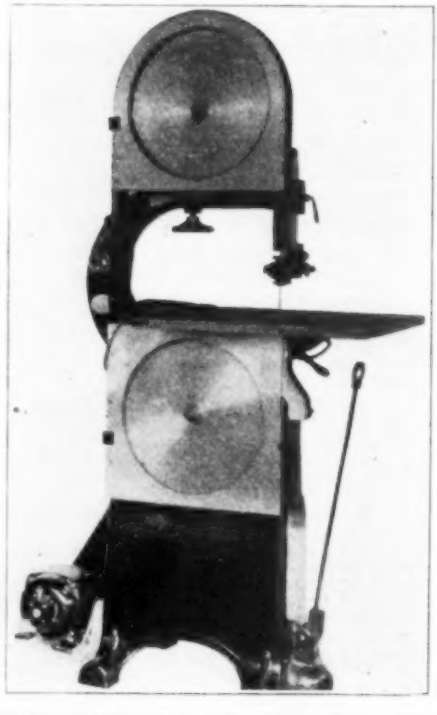
an adjustable distance safety valve located in the ram head of the press. The latter device automatically controls the stroke of the ram. The operating valve has three operating positions within a 90-degree arc. The position at the extreme right gives the down stroke and the extreme left the up stroke, while placing the lever in the central position stops the ram at any point on the up or down stroke.

The capacity of the press is 150 tons and the working height is optional up to 52 inches between the platen and ram. The floor space required by the pump and press is 6 x 6 feet. The diameter of the ram is 6 inches, the diameter of the cylinder 10 inches, the length of stroke 11½ inches, the diameter of the platen 28 inches, the distance between the columns 36 inches and the diameter of the columns 3½ inches. A 5-horsepower motor is used running at 1750 revolutions per minute. The approximate weight of the pump is 900 pounds.

Aluminum Wheels Used on Band Saw

A motor driven band saw with aluminum disk wheels recently has been introduced by the F. H. Williams Co., Meadville, Pa. The wheels are 18 inches in diameter, are faced with rubber and have ball bearings throughout. The upper and lower wheels are guarded with a special aluminum guard. The cast iron table is 22 x 24 inches and tilts 45 degrees to the right.

Band saw blades 10 feet long and either ¼ or ½-inch in width may be used. The machine is supplied regularly with a ½-horsepower motor, single phase, 60 cycles, 110 volts. The motor may be mounted on a bracket for belt drive or on a bracket at the back of the machine for gear drive. A switch, cord, and socket attachment plug for operating on the lighting circuit also are supplied. The machine may also be supplied with a single phase, 60-cycle, 220-volt alternating current motor which uses two wires of the regular three phase power line. Motor for direct current as well as for three phase also will be supplied where required.



THE MOTOR MAY BE ARRANGED FOR BELT OR GEAR DRIVE

Sight Market Improvement

Manufacturers Anticipate Improvement from Good Inquiries Now Current—October Sales Have Slight Edge on September Orders—Exports Decline

WHILE the improvement in the foundry equipment market has not been as great since the Detroit exhibition as was expected previous to that event, a number of manufacturers throughout the country secured a greater volume of sales in October than in September. In the Cleveland territory the market is spotty with inquiries pointing to a healthier condition in the near future.

The Chicago market continues dull. Sales for October were practically on a par with those of the previous month, the total for which left considerable to be desired. No large inquiries are reported as pending and sales in most instances are for single items of equipment.

Sales of equipment in New England showed a decided improvement in October. Several foundry additions and new foundries accounted for a number of molding machines and some sand handling apparatus. The improvement in the textile industry already has been reflected in equipment sales. The Eastern Brass Foundry, Inc., Cambridge, Mass., which recently was formed, is in the market for equipment.

Expected sales as a result of the Detroit show have not materialized in the Pittsburgh territory in many cases, but October sales compared favorably with September. Some large buyers still defer action; foundries at Buffalo and Zanesville, O., are about to purchase medium-sized cupolas; a foundry at Birdsboro, Pa., wants core ovens; the Southern Wheel Co., Toledo, O., is in the market for considerable equipment, as is the Charleroi Steel & Foundry Co., Charleroi, Pa. The Shoop Bronze, Tarentum, Pa., and the Flynn-Wolff Bronze Foundry, Swissvale, Pa., both want brass furnaces. A large number of molding machine inquiries are pending. The Bethlehem Steel Corp. is understood to have decided not to buy its cupolas, and the Baldwin Locomotive Works which inquired for two large ladles has decided to make them. The general outlook in foundry equipment is bright for several weeks to come since activity among most foundries is maintained at a high rate.

Foundry equipment buying in the New York Metropolitan district is restricted largely to small units and supplies. All in all, the market is sluggish, showing little or no improvement over conditions prevailing for several weeks past. There is a notable lack of new construction, which would lead to sizable lists. Orders for cupolas and other melting units are the lightest in considerable time, and much the same situation is said to apply to sand blast equipment.

According to a report of the Foundry Equipment Manufacturers' association, Cleveland, the value of equipment sold in September was $400,464 as compared with $343,351 in the corresponding month a year ago. Shipments in September were valued at $377,798 as compared with $378,601 in September, 1925. The value of orders on hand on Oct. 1 was $522,273.

Exports of foundry and molding equipment in August was $97,903, according to the department of commerce, bureau of foreign and domestic commerce. The exports declined slightly compared with July when the value was $105,618.

CHICAGO MARKET

Dust Arrester Equipment

Greenlee Bros. Foundry Co., Rockford, Ill.; Eureka Steel Range Co., O'Fallan, Ill.; Federal Malleable Co., West Allis, Wis.; from the Pangborn Corp., Hagerstown, Md.

Molding Machines

Damascus Steel Casting Co., Hammond, Ind., Busch-Selzer Bros. Diesel Engine Co., St. Louis; one roll-over machine each from the Herman Pneumatic Machine Co., Zelienople, Pa.

Shakeout Equipment

Holland Furnace Co., Holland, Mich., vibrator and shakeout equipment; from the Stoney Foundry Engineering & Equipment Co., Cleveland.

Sand Preparing Equipment

Butler Mfg. Co., Indianapolis, one mixer; Home Furnace Co., Holland, Mich.; one mixer from the Standard Sand & Machine Co., Cleveland.

Gardner Governor Co., Quincy, Ill., sand mixer; General Foundries Co., Flint, Mich., sand mixer; McNally Tolleson Foundry Co., Stoughton, Wis., two sand mixers; Rogers Foundry & Mfg. Co., Joplin, Mo., sand mixer; from the National Engineering Co., Chicago.

E. T. Fairbanks Co., Quincy, Ill.; Superior Nonferrous Foundry Co., South Bend, Ind.; Muncie Malleable Foundry Co., Muncie, Ind.; Prime Mfg. Co., Milwaukee; John Deere Spreader Works, East Moline, Ill.; O'Malley-Beare Valve Co., Chicago; sand separators and blenders from Royer Foundry & Machine Co., Wilkes-Barre, Pa., through Page & Ludwick, Chicago.

Sandblast Equipment

Warman Steel Castings Co., Los Angeles; Hughes Tool Co., Houston, Tex.; from the Pangborn Corp., Hagerstown, Md.

NEW YORK MARKET

Molding Machines

Farrum Castings Co., Middletown, N. J., two jar squeezers and rollover machines; from Tabor Mfg. Co., Philadelphia.

Sandblast Equipment

W. Cannings Co., Birmingham, England; Neemes Foundry Co., Troy, N. Y.; Crowe's Iron Works, Ltd., Guelph, Ont.; from the Pangborn Corp., Hagerstown, Md.

H. B. McKay, Sunshine, Victoria, Australia, sand mixer from National Engineering Co., Chicago.

Shakeout Equipment

New York Air Brake Co., Watertown, N. Y., vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland.

NEW ENGLAND MARKET

Dust Arrester Equipment

Plymouth Foundry Co., Plymouth, Mass., dust arrester equipment; from the Pangborn Corp., Hagerstown, Md.

Furnaces

Draper Corp., Hopedale, Mass., one cupola, spark arrester, roof hood, and fire brick lining from the Northern Engineering Works, Detroit, through W. Scott Thomas, Providence, R. I.

Molding Machines

George H. Lincoln Foundry Co., South Boston, two jar squeezers and rollover machines; L. F. Fales Foundry & Machine Co., Walpole, Mass., two squeezers; Barbour Stockwell Co., Cambridge, Mass., two jar squeezers and rollover machines; American Hardware Corp., New Britain, Conn., two shockless jarring squeezers; Hartford Foundry Co., Wethersfield, Conn., two jar squeezers; from the Tabor Mfg. Co., Philadelphia.

Sullivan Machine Co., Claremont, N. H., one roll-over machine; Windsor Foundry Corp., Windsor, Vt., one roll-over machine; from the Herman Pneumatic Machine Co., Zelienople, Pa.

Sand Preparing Equipment

H. Morgan Smith Co., York, Pa., one sand mixer with elevating equipment from the Standard Sand & Machine Co., Cleveland.

Miscellaneous

Hopedale Mfg. Co., Hopedale, Mass., one brinell hardness testing machine and one transverse testing machine; from W. Scott Thomas, Providence, R. I.

Turner & Seymour Mfg. Co., Torrington, Conn., pouring device equipment; from Whitehead Bros. Co., Providence, R. I.

PITTSBURGH MARKET

Dust Arrester Equipment

Columbia Iron Foundry, Philadelphia, from the Pangborn Corp., Hagerstown, Md.

Molding Machines

Niagara Radiator & Boiler Co., North Tonawanda, N. Y.; National Tube Co., Ellwood City, Pa.; one roll-over machine each from the Herman Pneumatic Machine Co., Zelienople, Pa.

Sandblast Equipment

U. S. Sanitary Mfg. Co., Pittsburgh, from the Pangborn Corp., Hagerstown, Md.

CLEVELAND MARKET

Dust Arrester Equipment

Electro-Alloys Co., Elyria, O.; Ensign Foundry Co., Toledo, O., from the Pangborn Corp., Hagerstown, Md.

Sandblast Equipment

Packard Motor Car Co., Detroit; Grant Bros. Foundry Co., Detroit; J. W. Pohlman Foundry Co., Buffalo, from the Pangborn Corp., Hagerstown, Md.

Shakeout Equipment

Port Hope Sanitary Mfg. Co., Port Hope, Ont.; shakeout bails; Cadillac Motor Car Co., Detroit, Ferro Machine & Foundry Co., Cleveland, vibrator and shakeout equipment; from the Stoney Foundry Engineering & Equipment Co., Cleveland.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Shriver Foundry Co., Maryville, Tenn., will build a foundry building 80x150 feet to replace a building recently burned.

Crown Pipe & Foundry Co., Jackson, O., will build a plant here for the manufacture of castings.

Delaware Brass Co., Harrison street, Delaware, O., J. P. Slater general manager, will build an addition to its plant.

Marine Brass Works, Wilmington, Calif., J. N. Thomas manager, is building a plant at 227 Island avenue, 40x70 feet.

Pittsburgh Engineering Co., Jeanette, Pa., will build a foundry and storage plant 110x110 feet. E. W. Eckert, 420 Y street, Derry, Pa., is architect.

Lockwood Mfg. Co., Day Street, South Norwalk, Conn., hardware, has let contract to Russell Frost Jr., 50 West aveune, for a 1-story plant 40x100 feet.

Metric Metal Works, Erie, Pa., Frank H. Payne general manager, Payne avenue and Tenth street, is considering plans for a brass foundry adjacent to its plant.

George L. Clark Metal Last Co., Mishawaka, Ind., Harry W. Clark vice president and general manager, will build a 1-story foundry 50x60 feet.

Federal Furnace Co., 208 South La Salle street, Chicago, has been incorporated to manufacture iron and steel products by W. H. Velde, M. Holland and R. W. Campbell. Knapp & Campbell, 208 South La Salle street, are attorneys.

Griffin Wheel Co., Salt Lake City, Utah, is building car wheel manufacturing plant at Eighth West and Eighth North streets where 14 acres has been bought. General offices of the company are at 332 South Michigan boulevard, Chicago.

Detroit Stoker Co., will open a manufacturing branch at St. Catharines, Ont., to take care of Canadian business, and all Detroit stokers for Canadian and English installation will be manufactured at the new branch.

Bridgeboro Foundry, Camden, N. J. has been incorporated with $25,000 capital and 1000 shares no par value to operate a foundry by George C. Prince, Charles A. West and F. A. Demars Jr., Camden. F. A. Demars Jr., Camden, N. J., is attorney.

Through an error, the Moore Engineering Co., Hagerstown, Md., was reported as changing its name to the Dixie Machine Co., in the Oct. 1 issue. The Dixie Machine Co., is a new organization which has leased the plant formerly used by the Moore company and has no connection with the latter named organization.

The city of Stoughton, Wis., which some time ago purchased the entire local plant of the Moline Plow Co. to attract new industries, has made arrangements with John E. McNally and E. M. Tollefson, who have been in the foundry business at Lake City, Minn., to take over the gray iron foundry plant. The McNally-Tollefson Foundry Co. has been incorporated in Wisconsin with $50,000 capital stock, to operate the plant. Orders are on hand to insure continuous output for several months. Automobile flywheels, pistons and similar parts will be made. The foundry was started Oct. 15.

Announcement of the reorganization of the Price-Evans Foundry Co., Chattanooga, Tenn., has been made. The company has been taken over by the Price-Evans Foundry Corp., the charter of the old company having been surrendered. Principals of the new company are H. F. Griscom, president; Dyer Butterfield, and W. B. Schoolfield. A. C. Converse, president of the old company, is retiring from the business. The new company is capitalized at $240,000. The Price-Evans Foundry Co. was organized in 1902 and has grown from a sash weight foundry to the largest company in the South doing ornamental and miscellaneous iron work.

New Trade Publications

REFRACTORIES—Ten attractive bulletins have been prepared for distribution by the Chicago Retort & Fire Brick Co., Chicago, covering numerous uses of its products.

TRAMRAILS—The Cleveland Crane & Engineering Co., Wickliffe, O., has issued a folder describing its tramrail systems for handling various kinds of materials.

STEEL FURNITURE—Berger Mfg. Co., New York, has issued an illustrated folder covering its steel office furniture, filing cases, safes, shelving and similar devices with dimensions and descriptions.

MOTORS—Repulsion-start, single phase induction motors is the subject of a pamphlet issued by the Century Electric Co., St. Louis. Operating features and mechanical construction details are included.

CASTINGS—William H. Barr Inc., Buffalo, has issued a catalog containing useful data concerning brass and bronze castings. Chemical and physical characteristics of various nonferrous alloys manufactured by this firm are given.

NICKEL STEEL—The International Nickel Co., New York, recently has issued three bulletins on nickel steel. One of the bulletins deals with the inspection, another with alloy steel die blocks and the third with automobile design and automotive steels.

CHAINS AND SPROCKETS—A new catalog has been prepared and issued by the Webster Mfg. Co., Chicago, covering its various types of chains and sprockets for a wide variety of uses. It is illustrated and shows installations in operation.

ALLOYS—The American Boron Products Co. Inc., Buffalo, has issued a 60-page booklet describing the various nonferrous alloys of its manufacture. These alloys may be used for alloying, deoxidizing and for solidifying purposes.

SANDERS AND GRINDERS—Motor driven sanders, grinders and bandsaws are shown in a pamphlet issued by the Porter-Cable Machine Co., Syracuse, N. Y. These machines may be used in pattern shops, machine shops, box factories and furniture factories.

ELECTRICAL DEVICES—Vapor proof condulets of various shapes and sizes for a variety of purposes are shown in a folder issued by the Crouse-Hinds Co., Syracuse, N. Y. These condulets are for use in installations where vapors, fumes, gases or dust are present.

WOODWORKING MACHINES—Portable woodworking machines for pattern shops, shipping rooms, woodworking plants, etc., are shown by illustrations in a catalog issued by the J. D. Wallace & Co., Chicago. Descriptions and features of construction of the machines are given.

RIGHT ANGLE DRIVES—Boston Gear Works Sales Co., Norfolk Downs, Mass., has issued a catalog covering its right angle drives, with worm, bevel, miter and spiral gears, standardized, for immediate delivery. Illustrations and data fully describe the various gears.

ELEVATORS—Portable elevators of various capacities manufactured by the New Jersey Foundry & Machine Co., New York, are shown in illustration in a folder issued by the firm. These elevators are either hand power or electrically driven and are made especially for materials handling.

BELTING—A report of tests of its belting by the Labaratoire d'Essais, Paris, has been reproduced in a booklet by E. F. Houghton & Co., Philadelphia. The report goes into the properties and operation of this class of belting and is illustrated by graphs showing performances under test and tables carrying similar information.

HARDNESS TESTER—A booklet by the Wilson-Maeulen Co. Inc., New York, contains a compendium of possibilities and current practices with one type of tester. The subjects covered include surfaces, skill, accuracy, range and adaptability, inspection, specifications and testing various classes of material.

PICKLING EQUIPMENT—Duriron Co. Inc., Dayton, O., has prepared a booklet describing pickling equipment for use in preparing iron and steel parts. These appliances use special acid-resisting metal made by this company to give long life under conditions which test the resisting qualities of metal. The booklet is illustrated to indicate the construction of the various devices and their use.